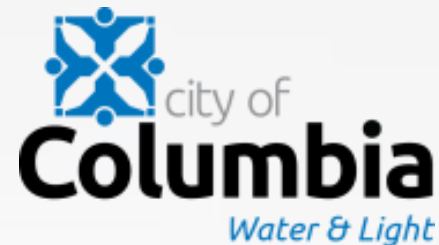


# McBaine Water Treatment Plant Improvement Project

## Pilot Testing and Alternatives Analysis

October 2021



# Presentation Agenda

- Project Overview
- Pilot Purpose and Findings
- Recommended Alternative
- Opportunities for Engagement



# Project Overview





# McBaine Water Treatment Plant

- Built in **1970**
- Serves **50,300 customers**
- Covers an **89 square-mile service area**



## LEGEND



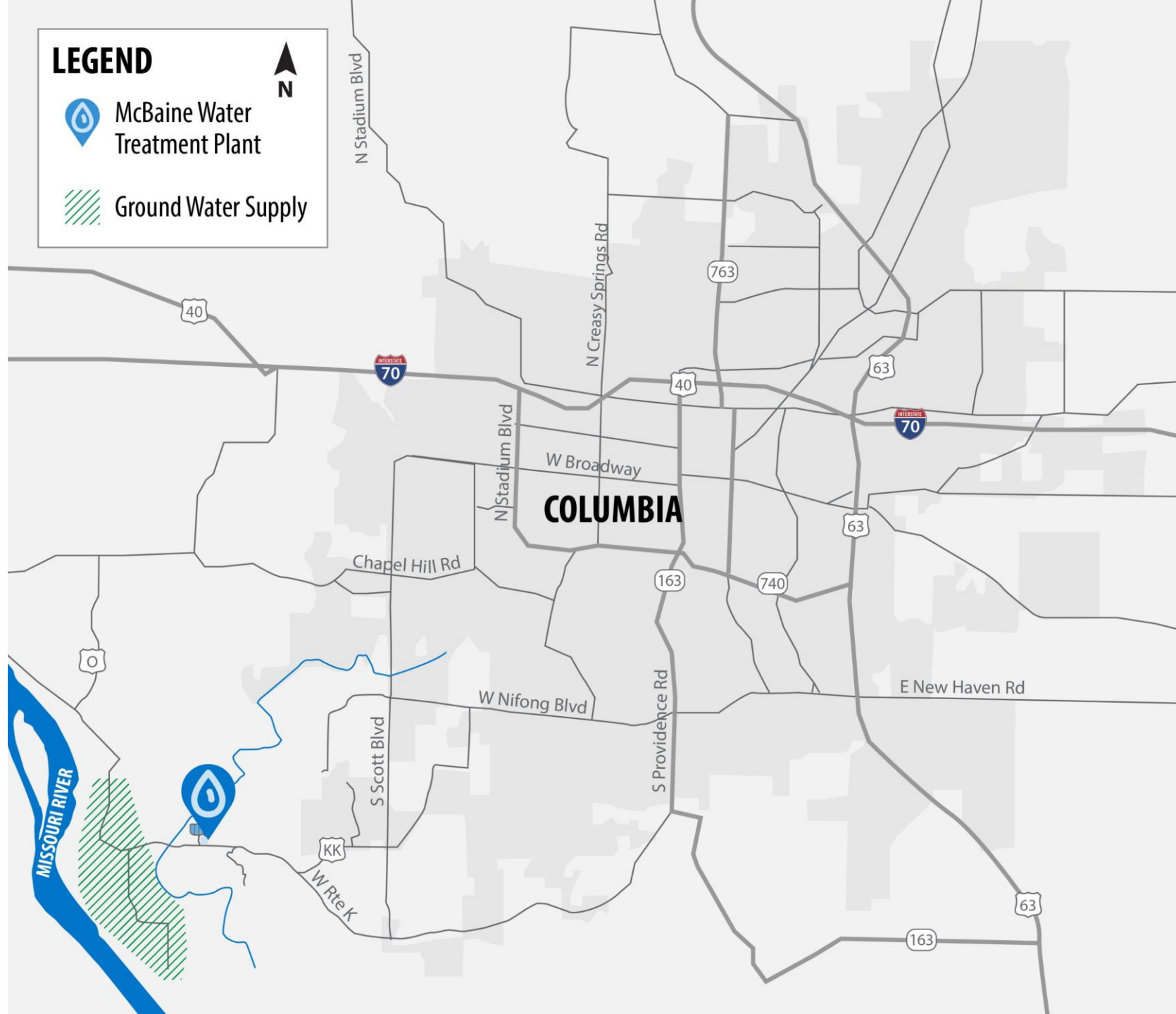
McBaine Water  
Treatment Plant



Ground Water Supply

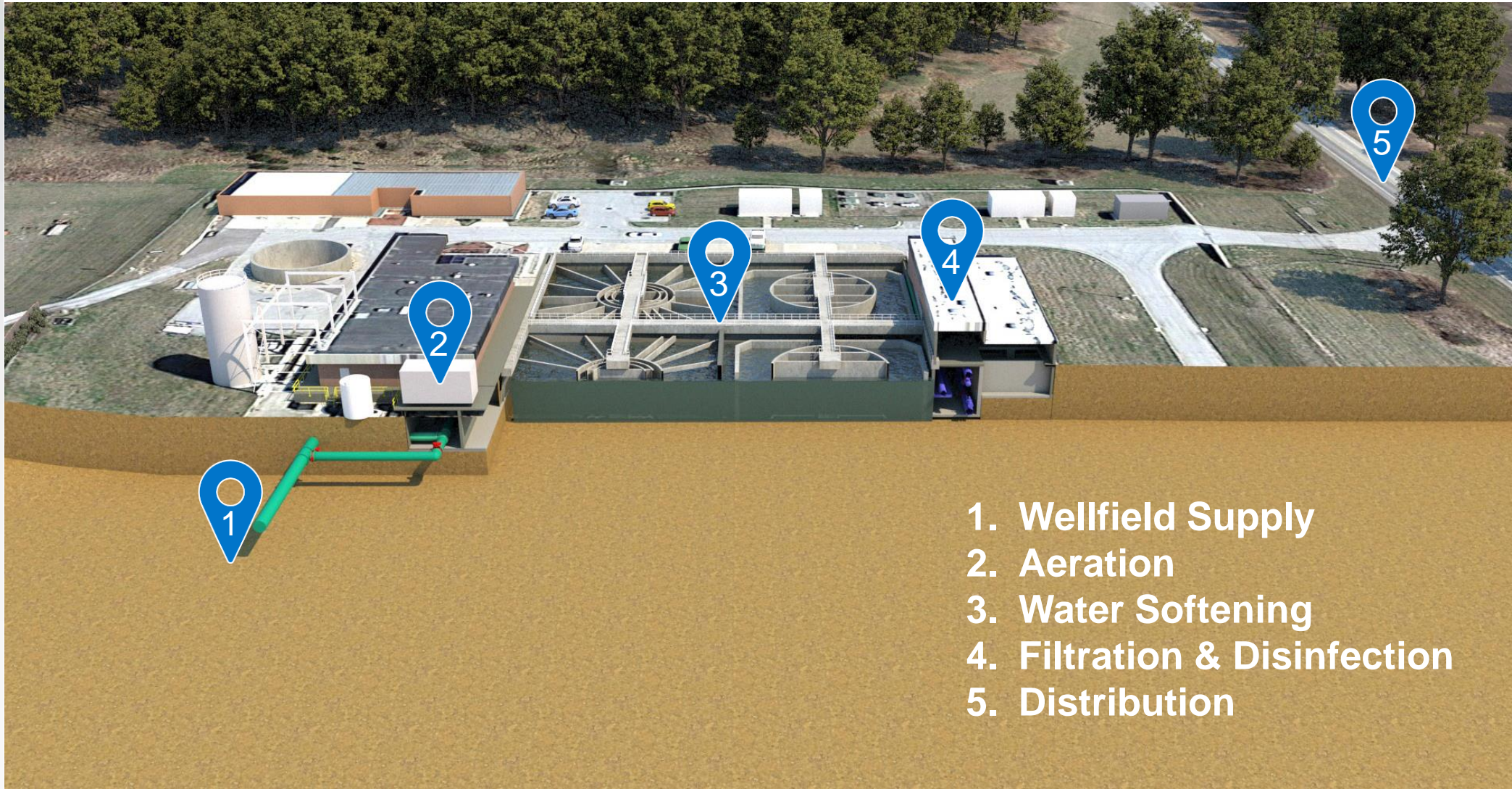


N





# How we deliver clean, safe water



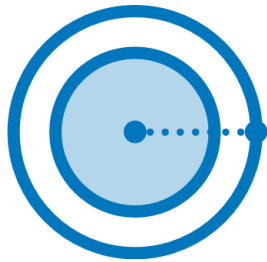
1. Wellfield Supply
2. Aeration
3. Water Softening
4. Filtration & Disinfection
5. Distribution



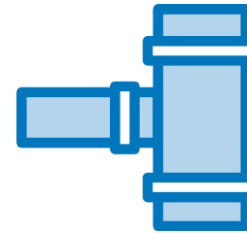
# Purpose



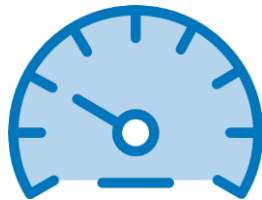
# Project Purpose



Replace aging infrastructure for enhanced reliability



Restore water treatment capacity



Improve current treatment performance



Prepare for potential future treatment enhancements

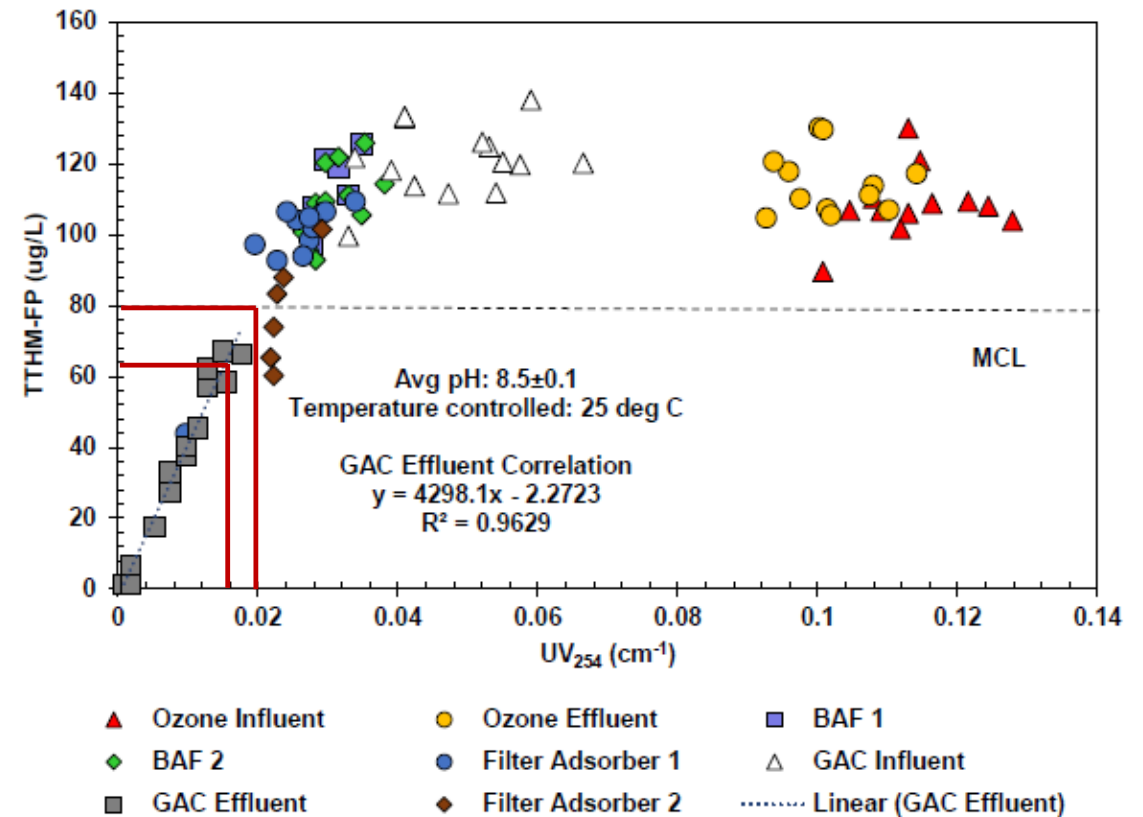
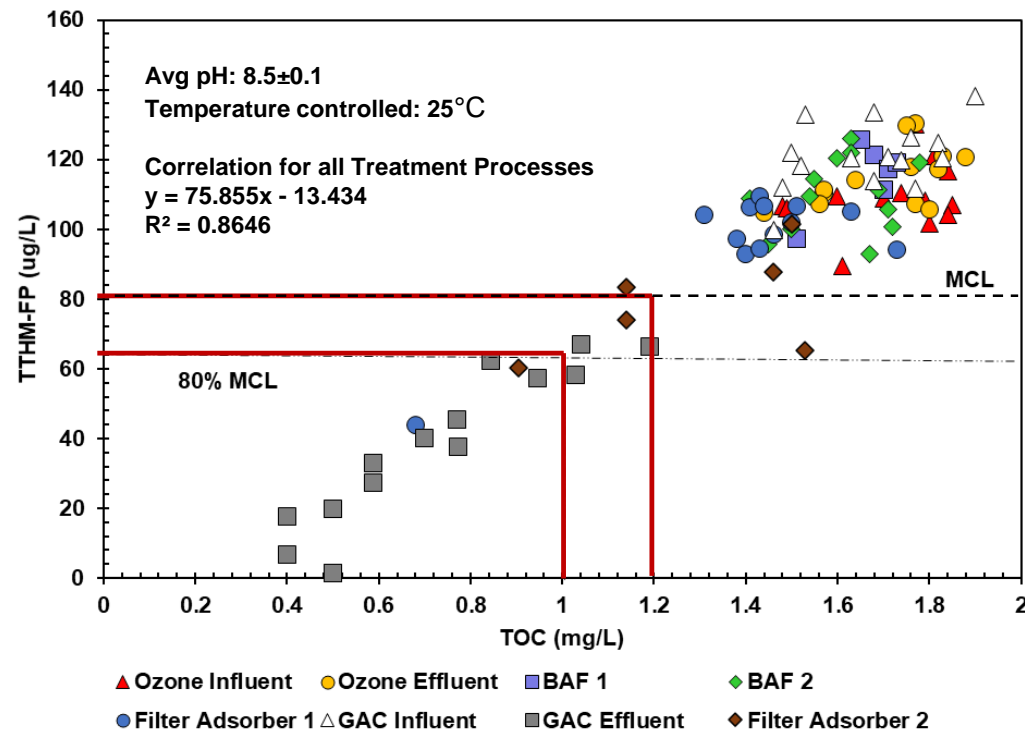


# Disinfection Byproduct Formation



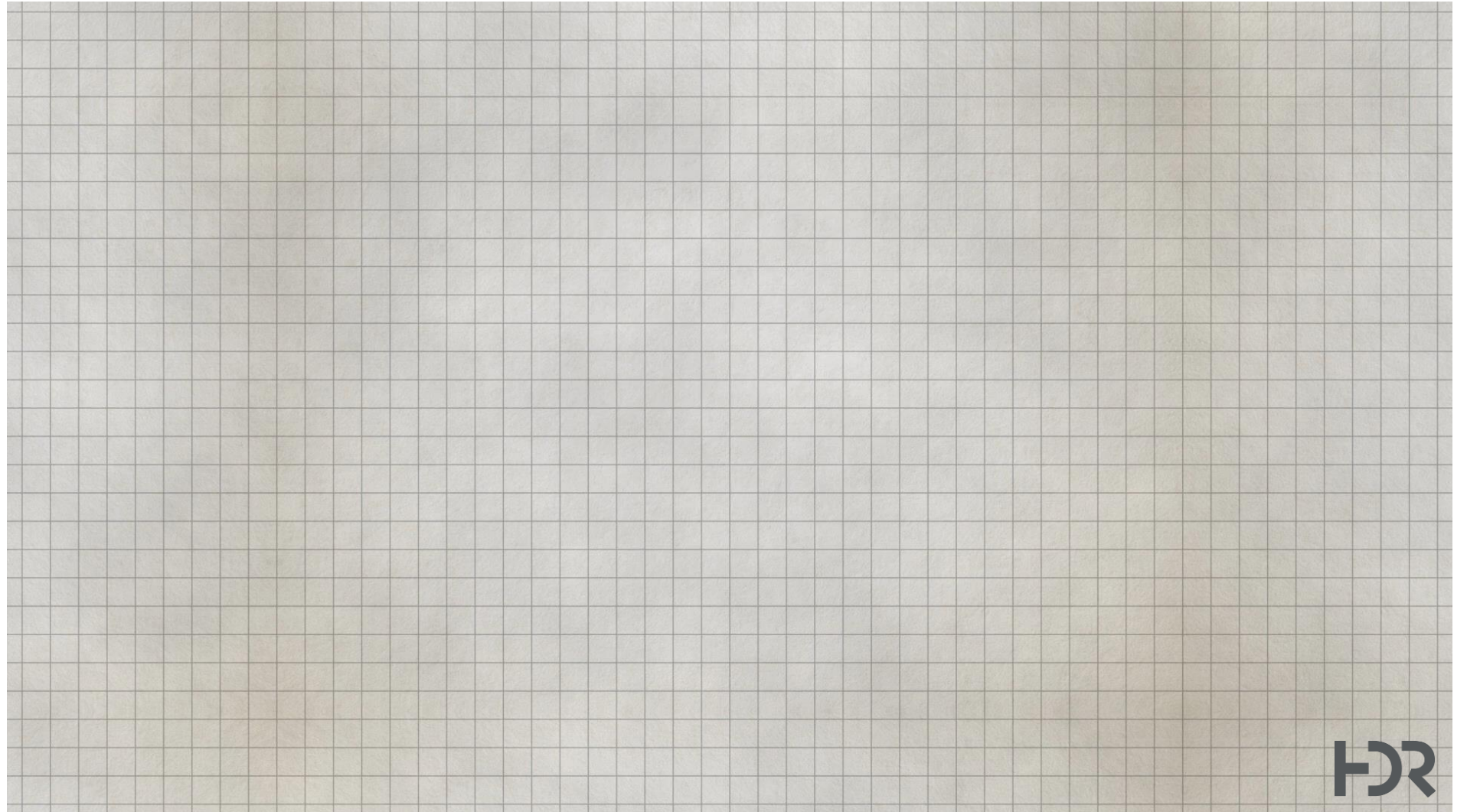
TOC and  $UV_{254}$  are measures of DBP precursors and serve as treatment targets to reduce DBP formation in the system.

# Disinfection By-Product Precursors & Surrogates

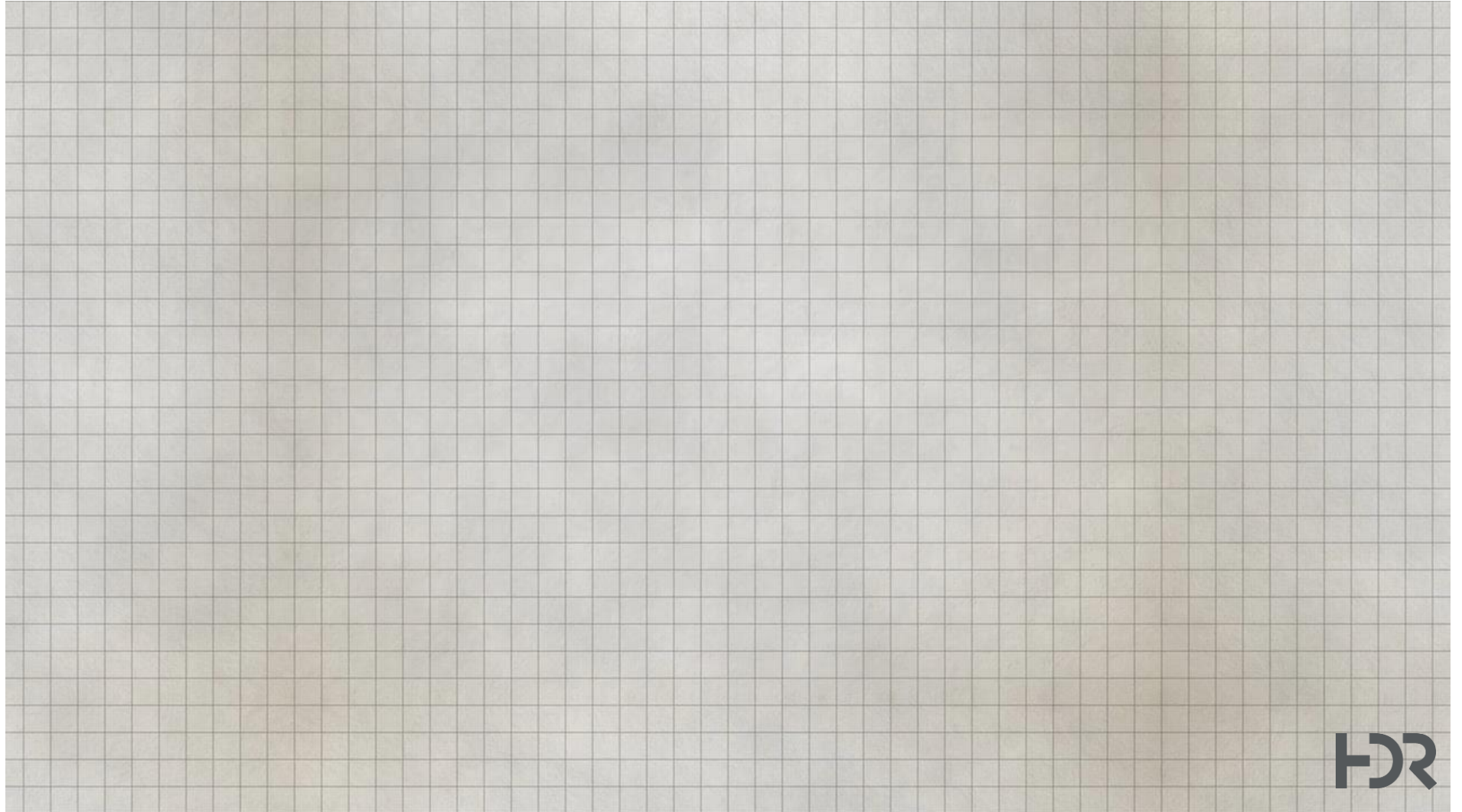




# Granular Activated Carbon Adsorption



# Ozone – Biologically Active Filtration



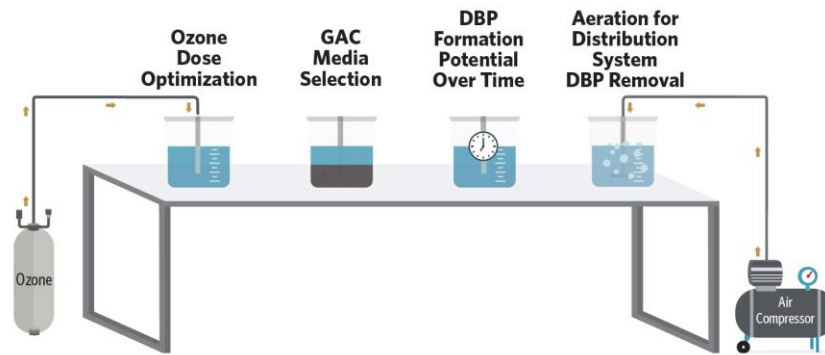


# Pilot Study and Alternatives Analysis Treatment Processes

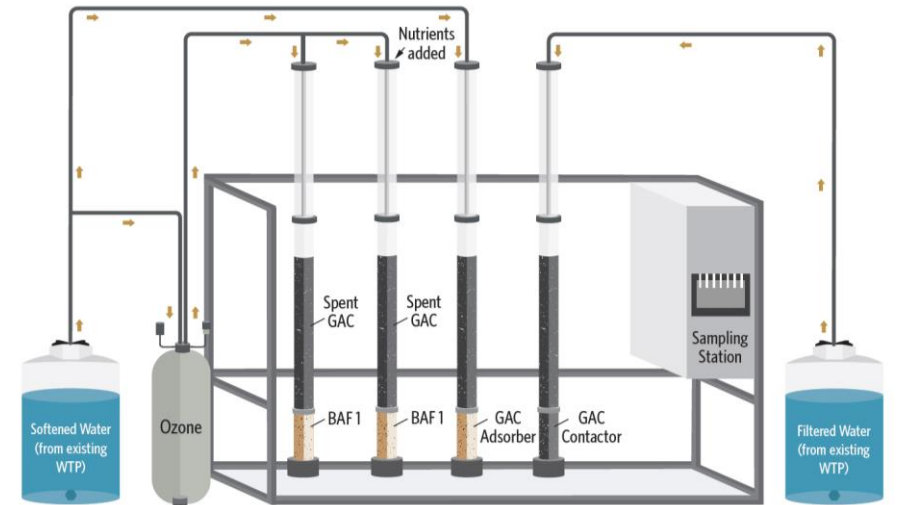
- Ozone – Biologically Active Filtration (BAF)
  - Integrate in existing filters or as post-filtration process
- Filter GAC Adsorbers
  - Replace anthracite cap in existing filters with GAC
- GAC Contactors
  - Add GAC Contactors following filtration
  - Add new High Service Pump Station (HSPS) & convert upcoming HSPS to Intermediate Pump Station

# Alternatives Analysis Purpose

Evaluate process enhancements to meet long term water quality goals



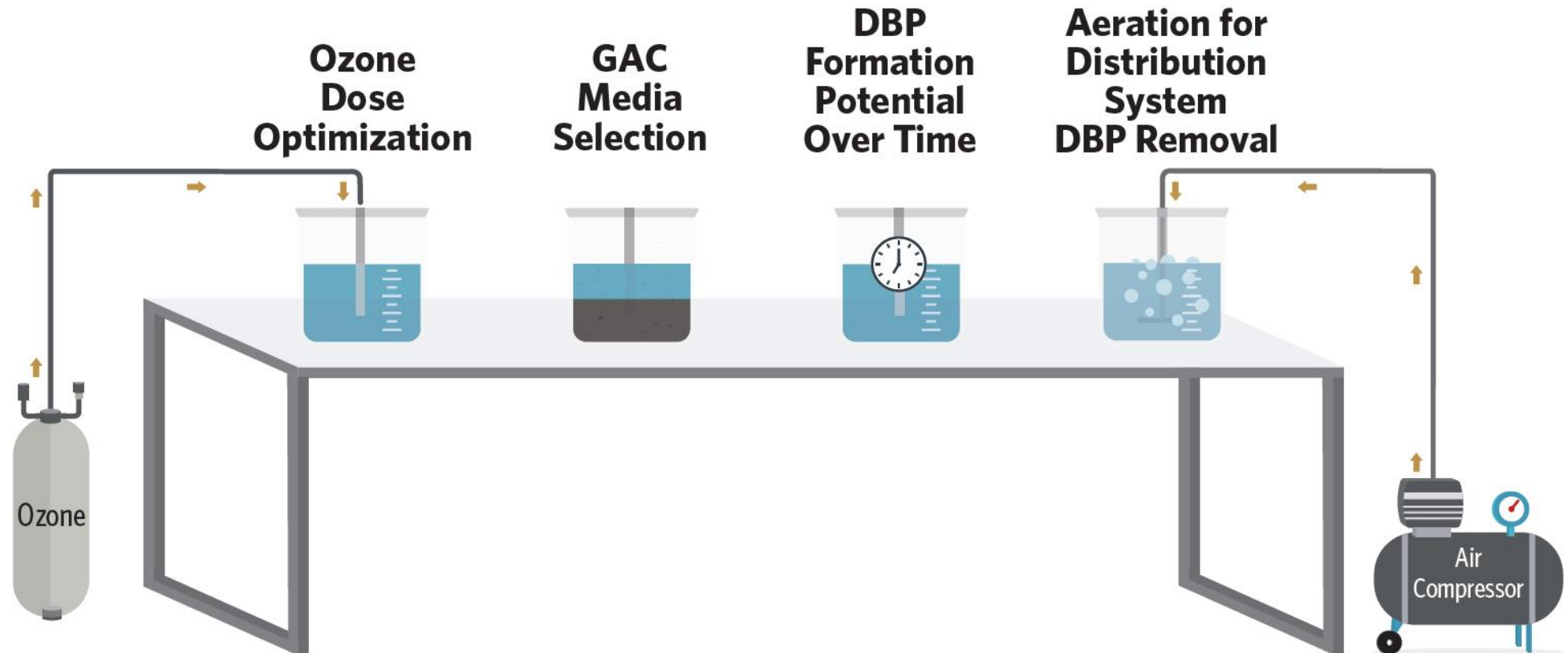
Bench-Scale  
Study



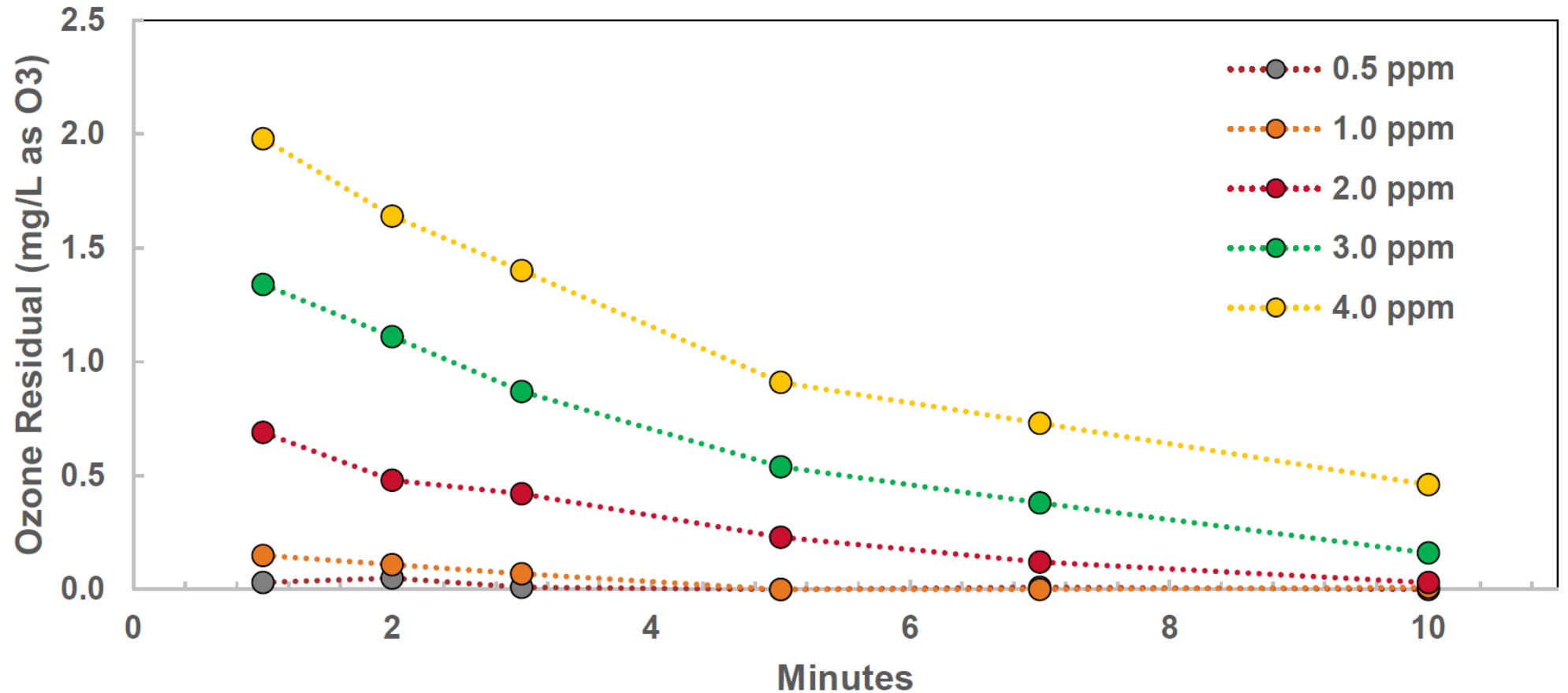
Pilot-Scale  
Study



# Bench-Scale Study

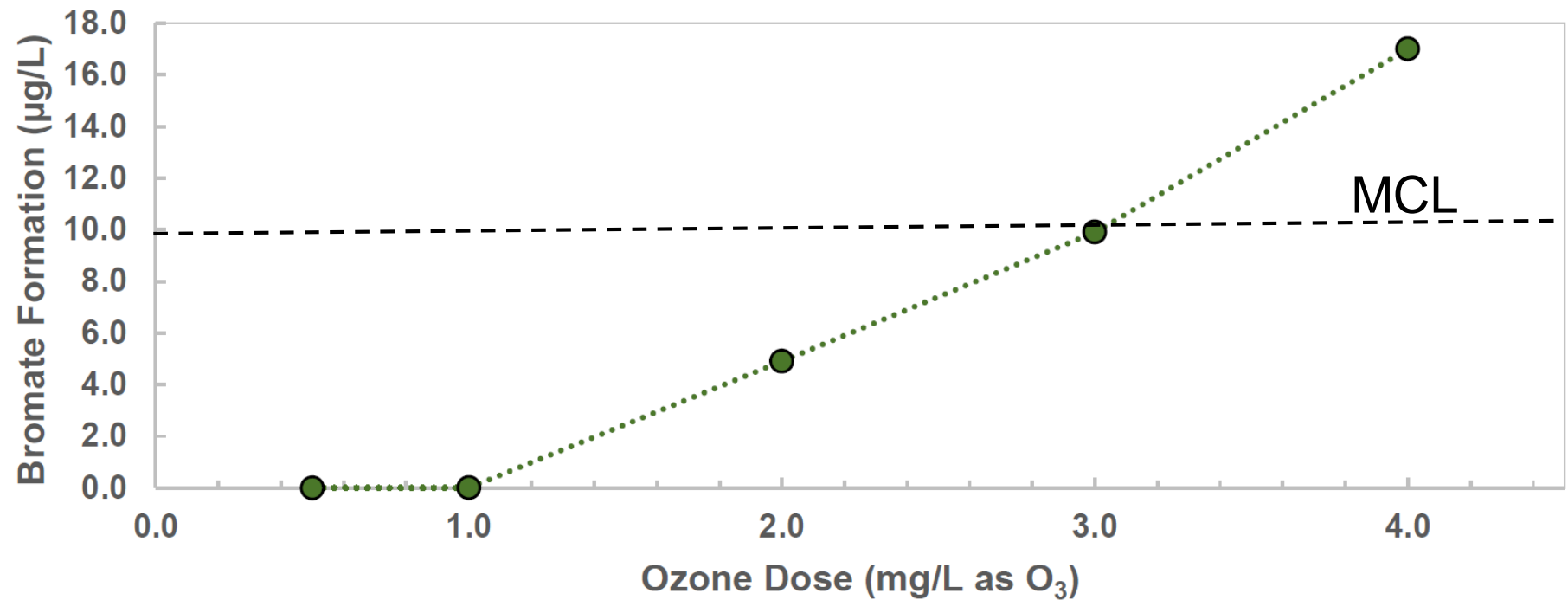


# Ozone Dose Optimization

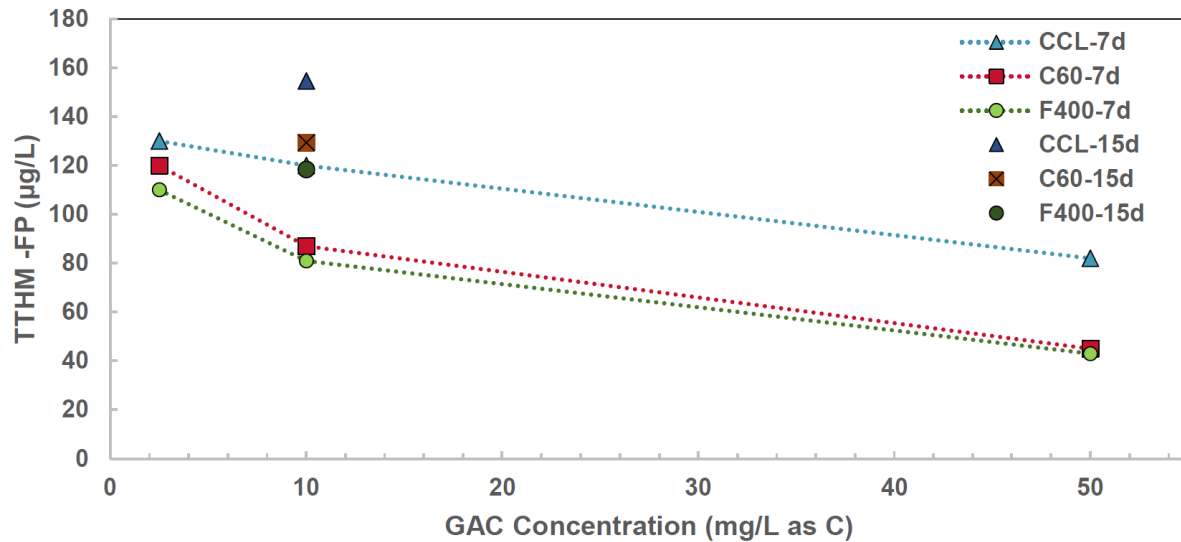




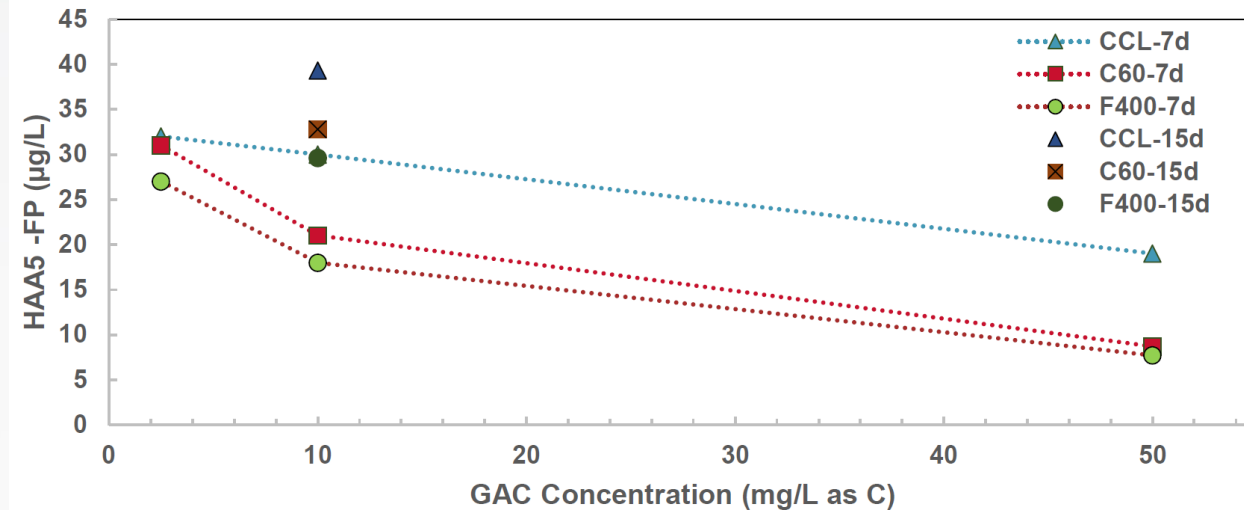
# Bromate Formation from Ozonation



# GAC Media Selection for Pilot-Scale Study



Total Trihalomethanes

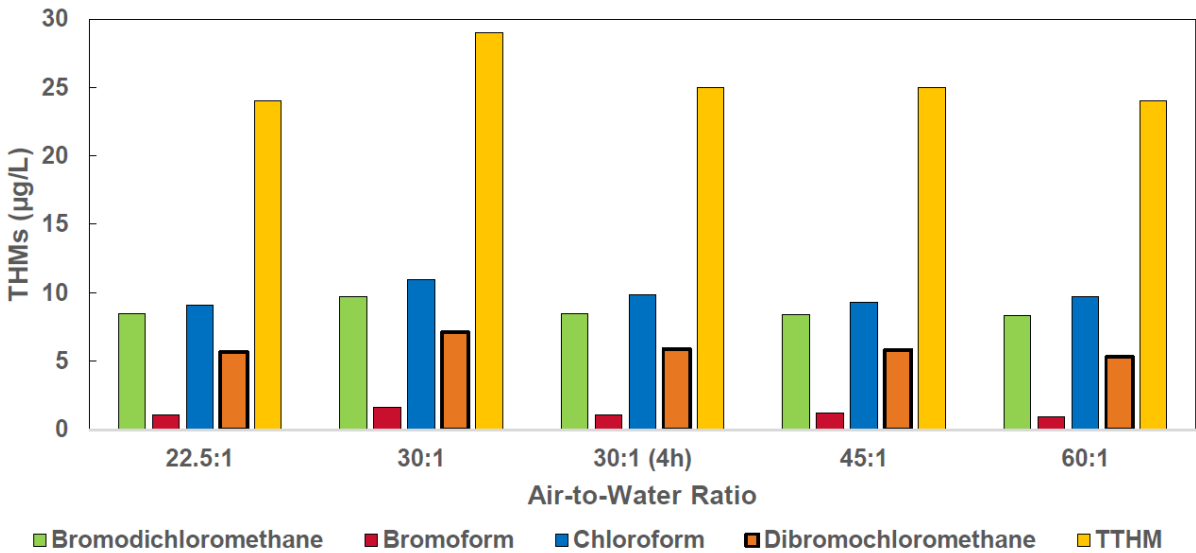


Haloacetic Acids

Calgon F400 selected as pilot-scale GAC Media.

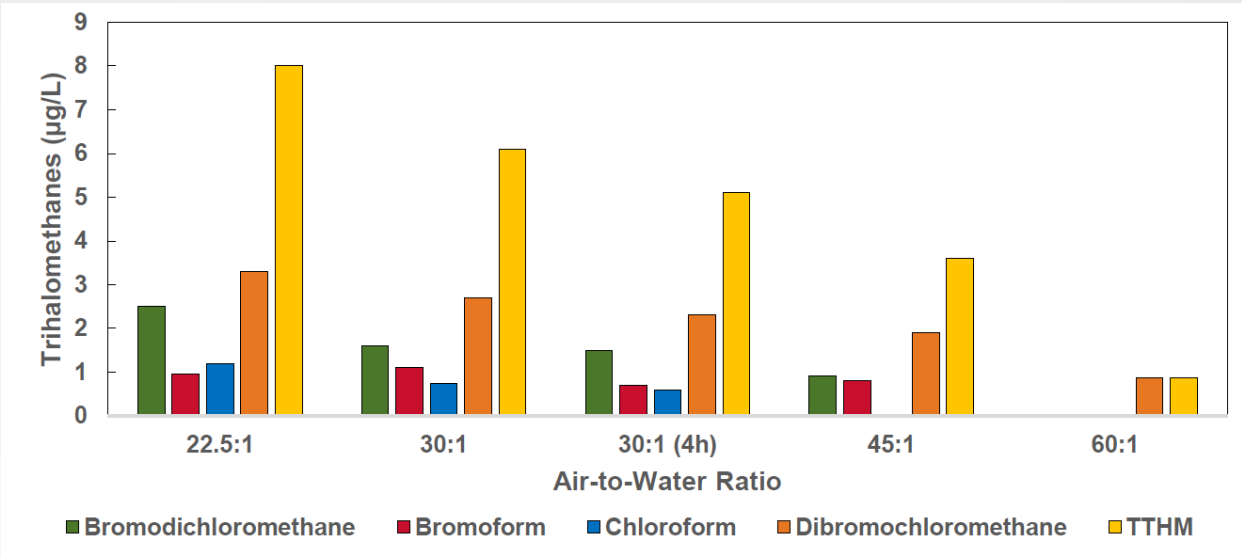


# Air Stripping Testing to Evaluate Potential Effectiveness at Full-Scale

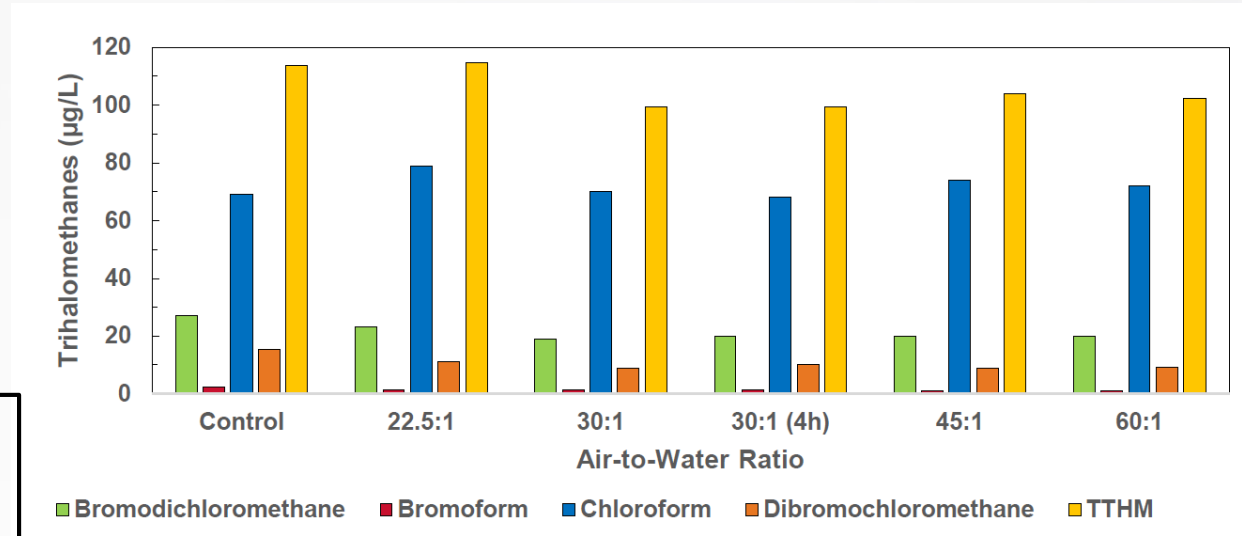


Prior to Aeration

TTHMs formation after aeration makes this alternative ineffective.



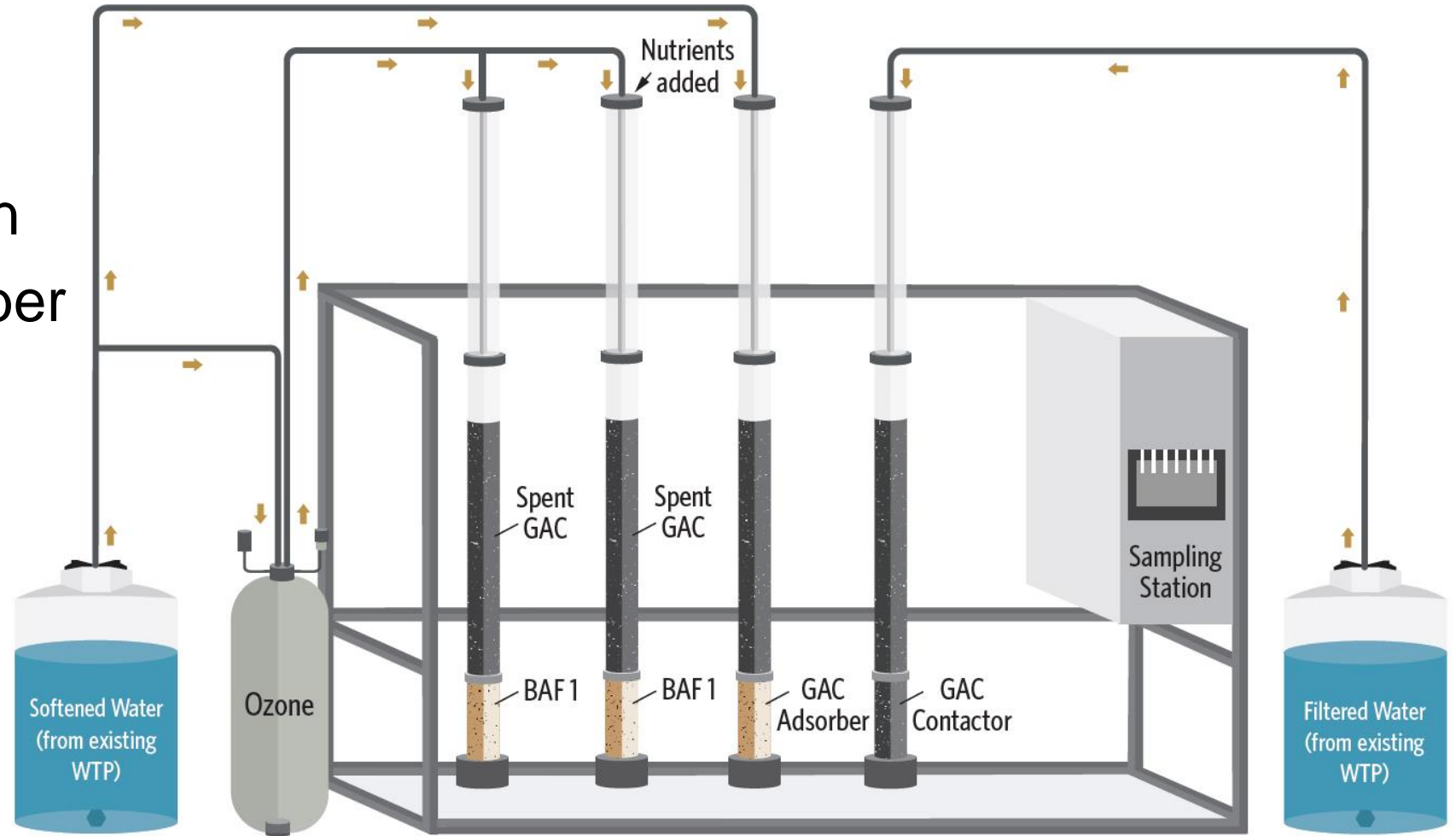
After Aeration



After 7-days of SDS

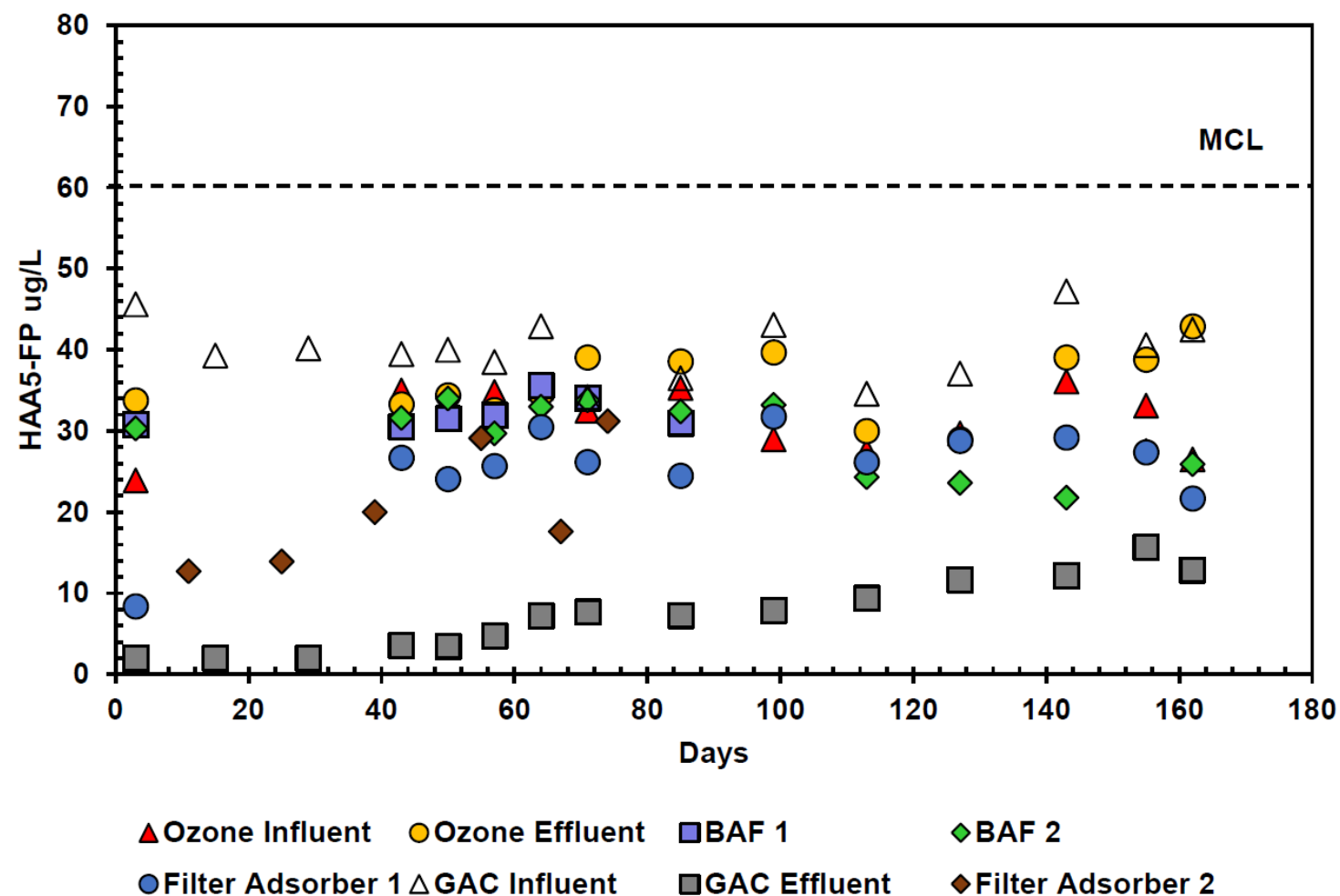
# Pilot-Scale Study

1. Ozone/Biofiltration
2. GAC Filter Adsorber
3. GAC Contactor

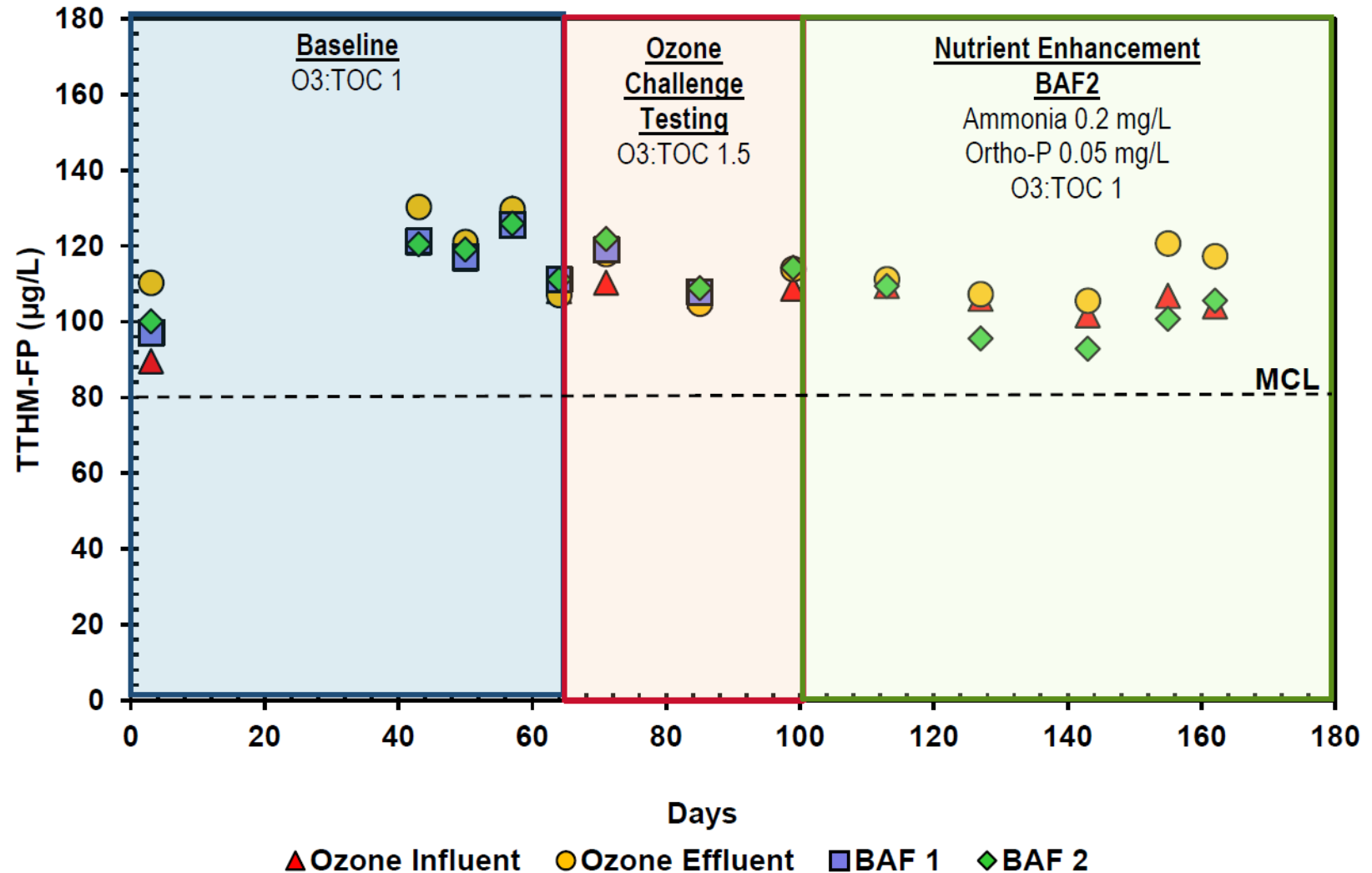




# Haloacetic Acid Formation Potential of All Pilot Effluents

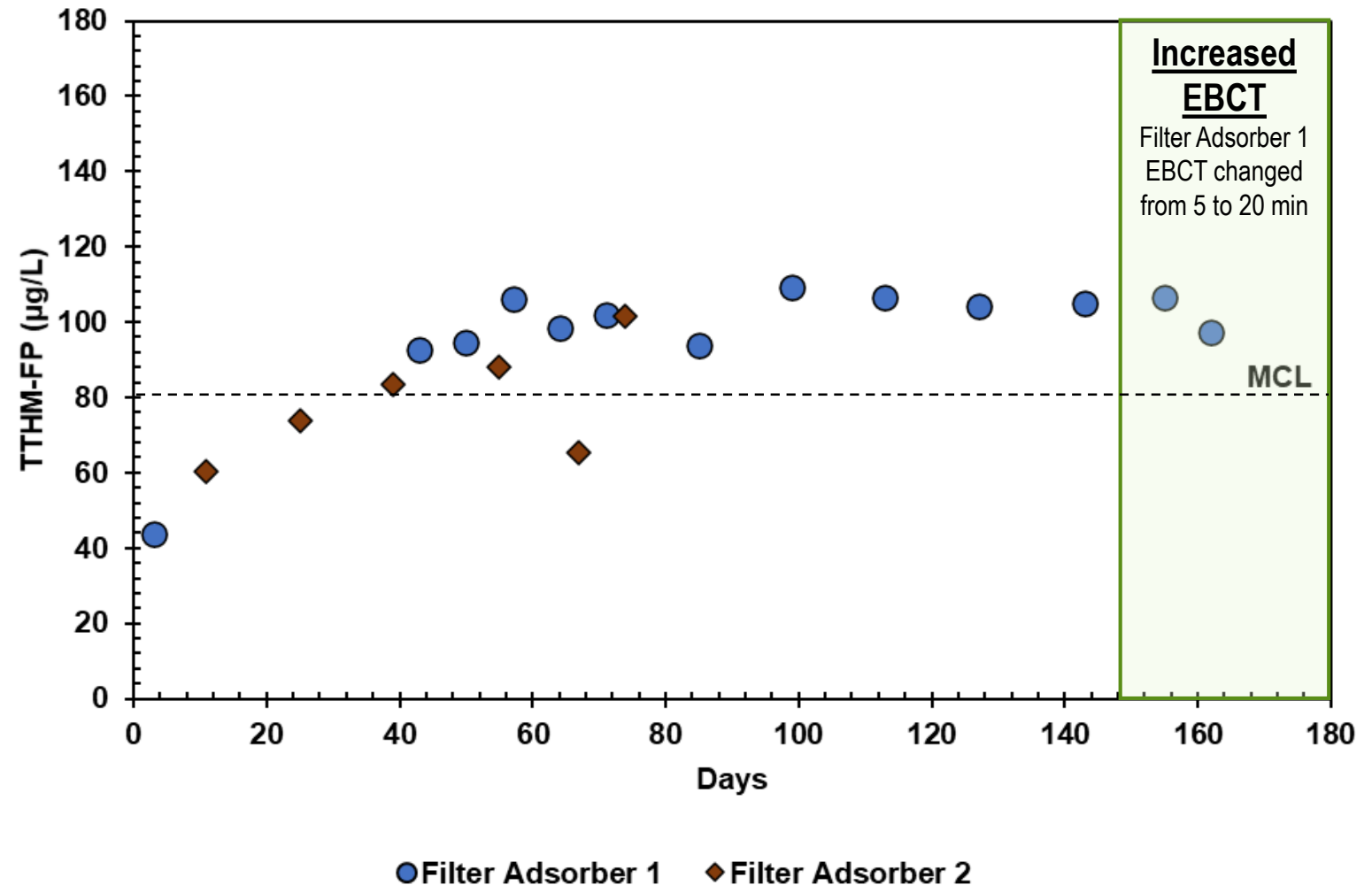


# TTHM Formation Potential of Ozone/Biofiltration Effluent

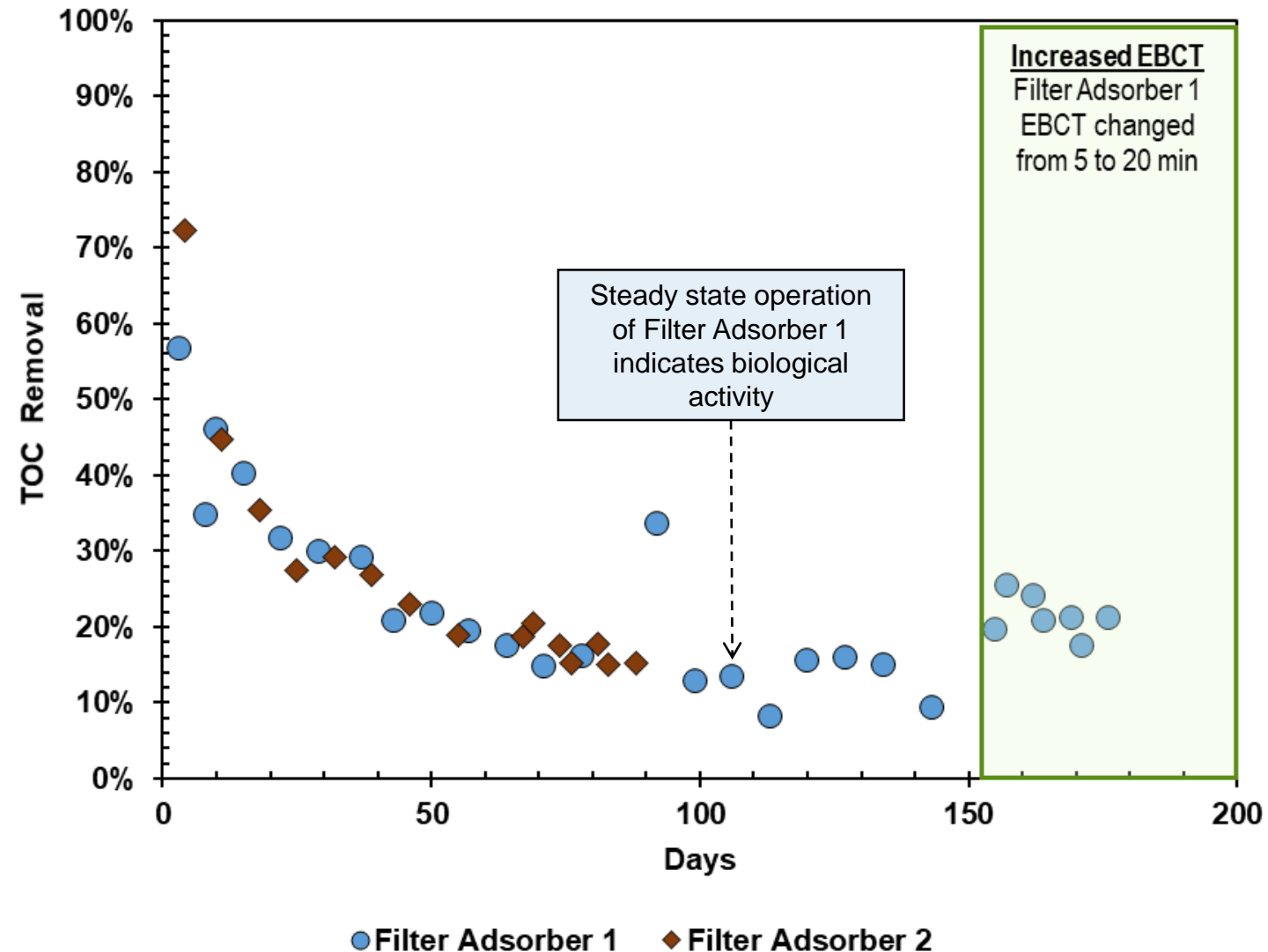




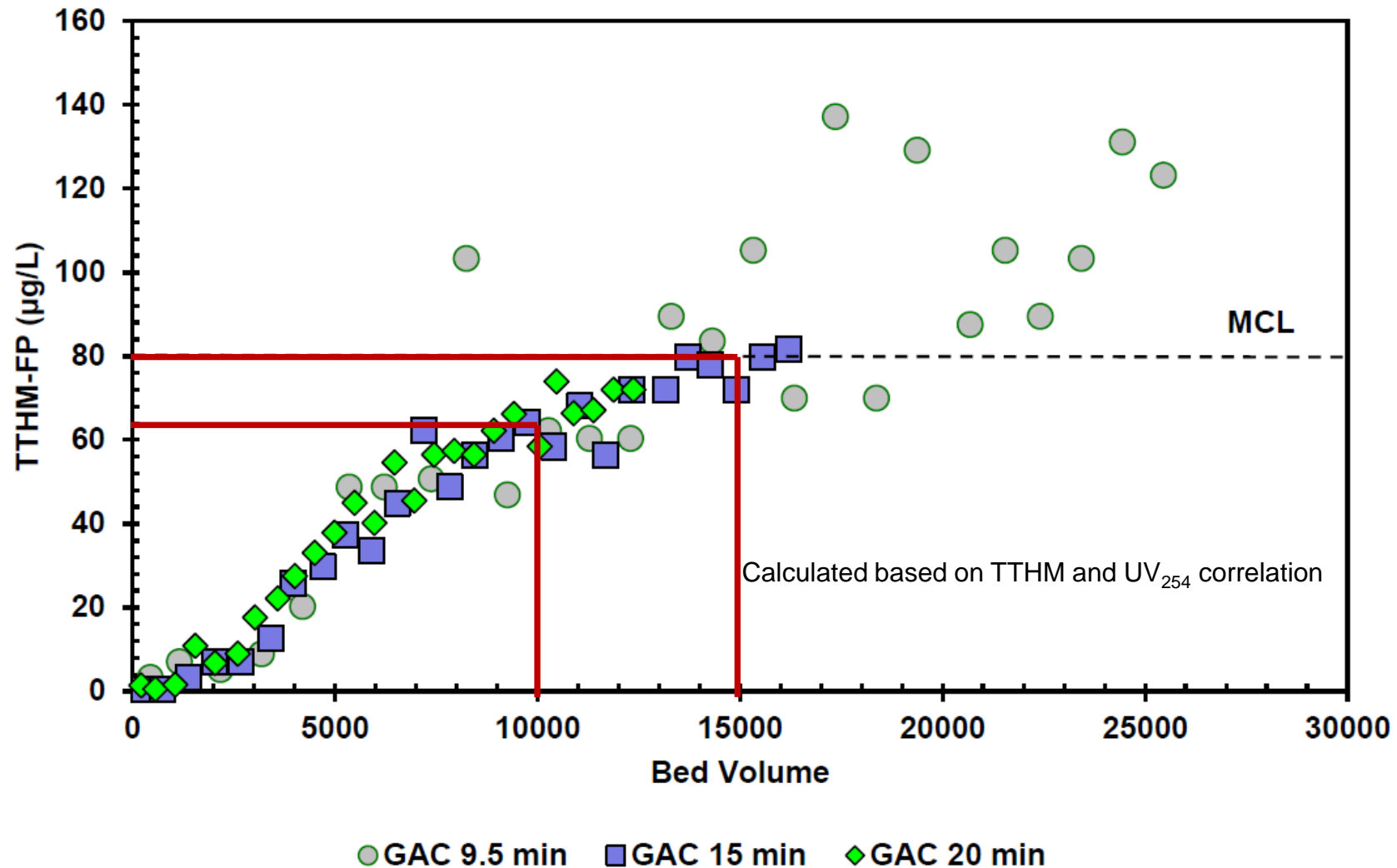
# TTHM Formation Potential of GAC Filter Adsorber Effluent



# TOC Removal of GAC Filter Adsorber

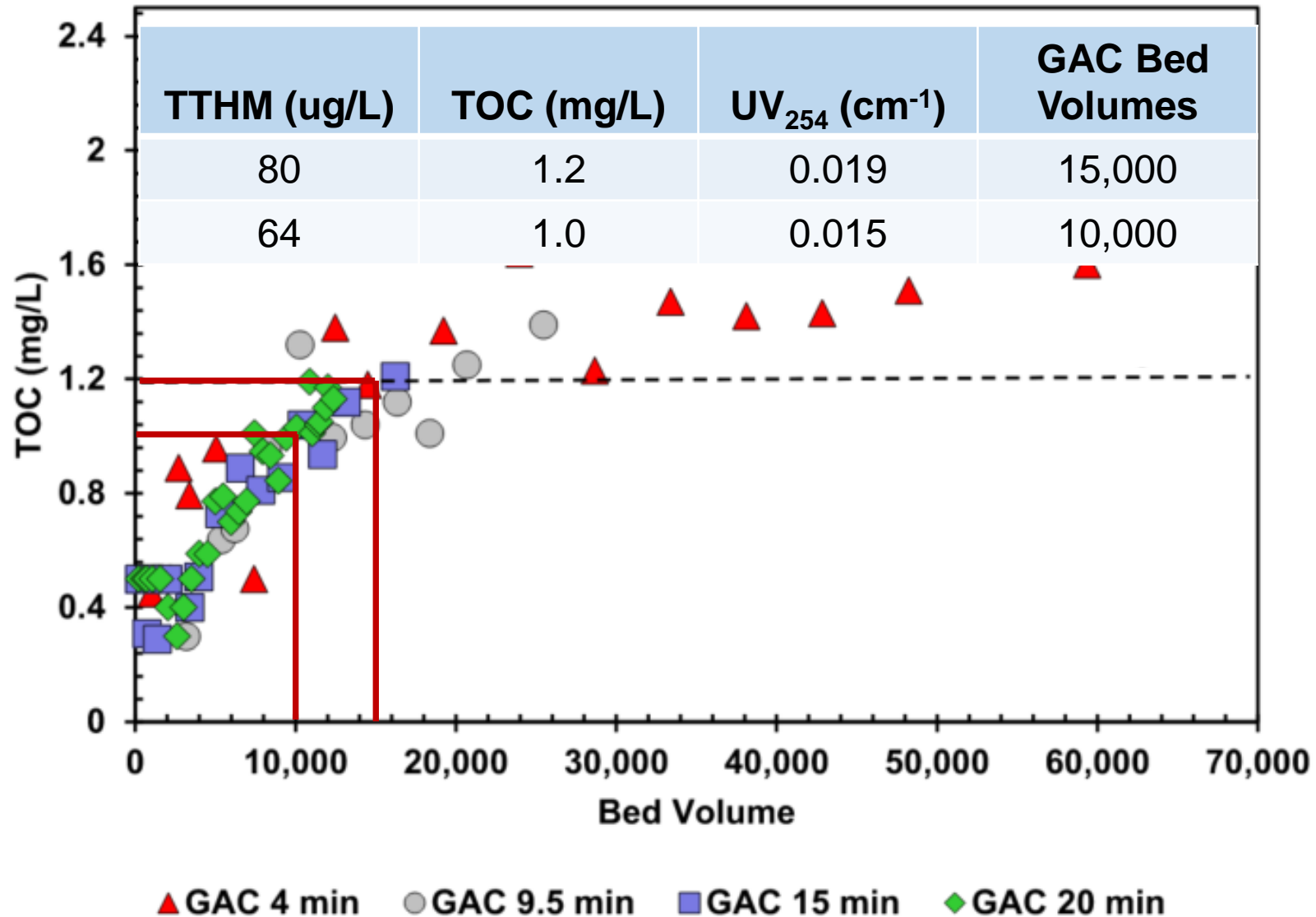


# TTHM Formation Potential of GAC Contactor Effluent



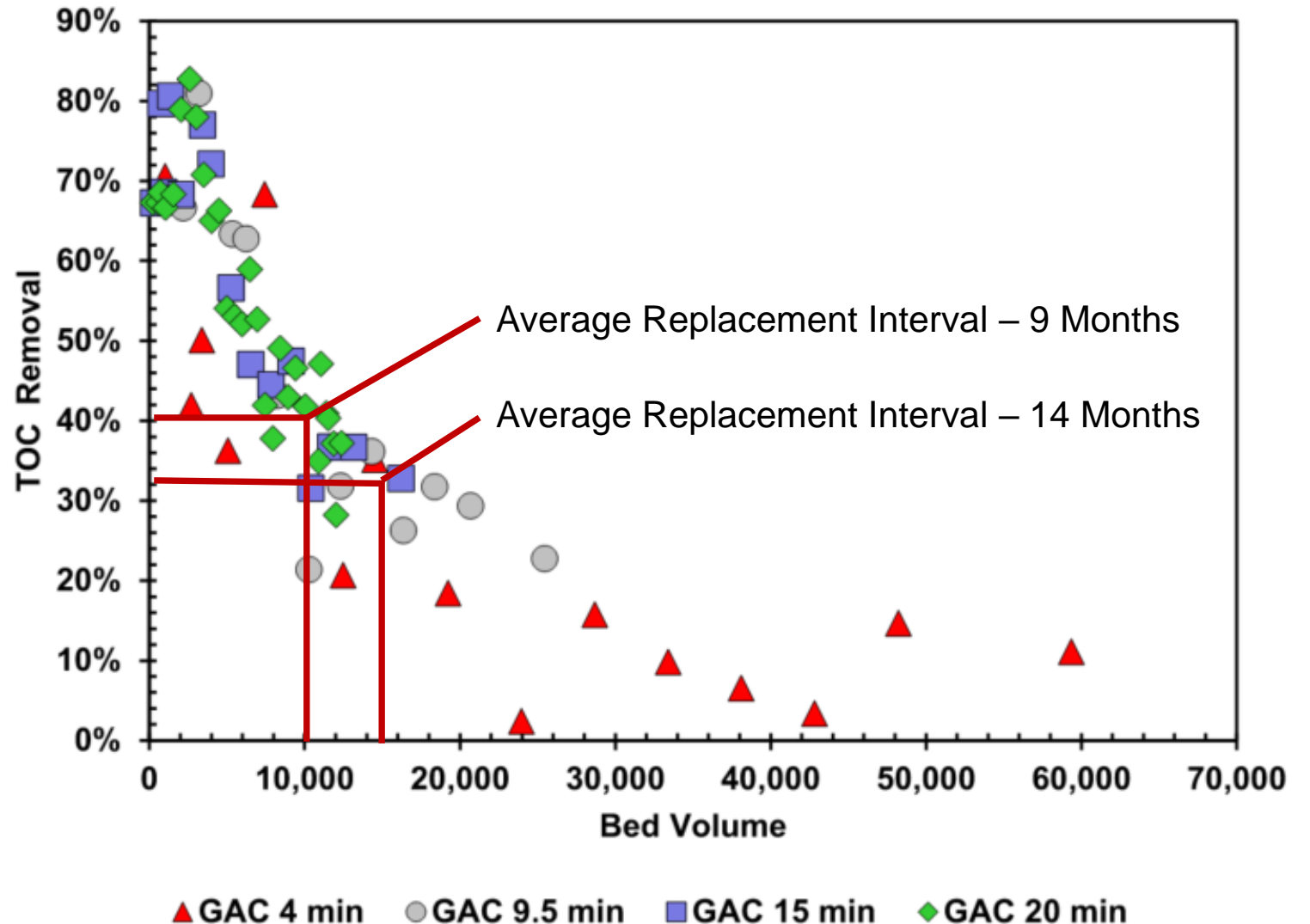


# TOC of GAC Contactor Effluent

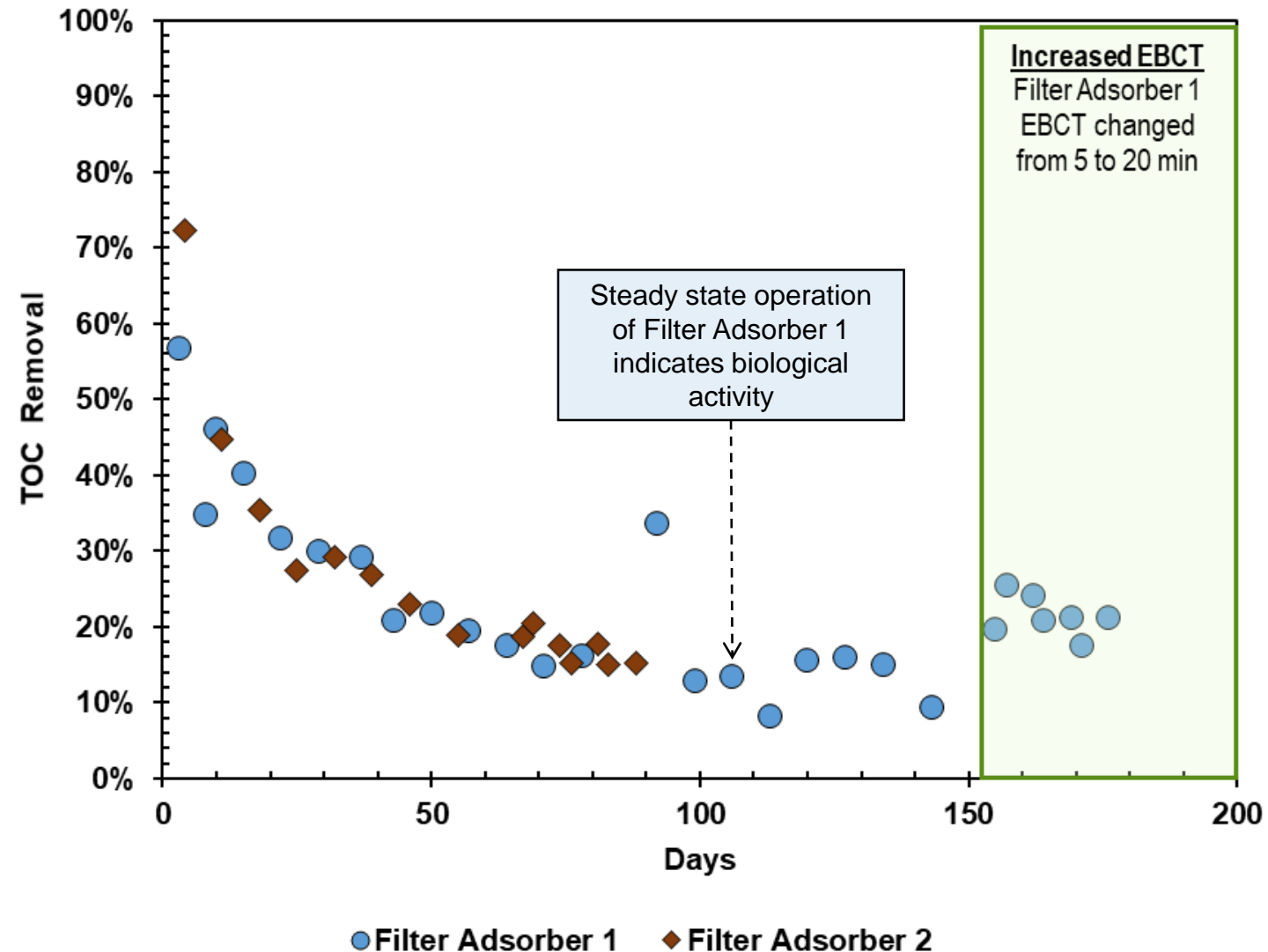


# TOC Removal of GAC Contactor

Target Bed Volumes & Replacement Intervals can be increased with additional TOC removal following upcoming WTP Improvements

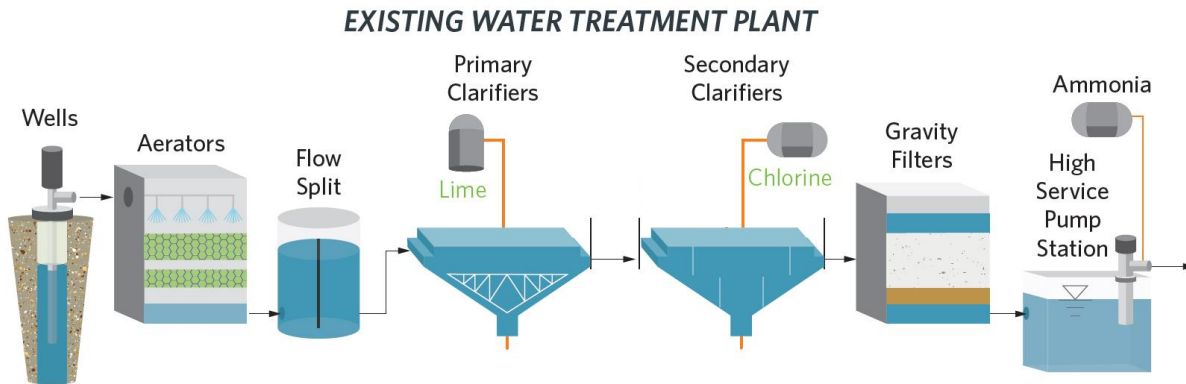


# TOC Removal of GAC Filter Adsorber

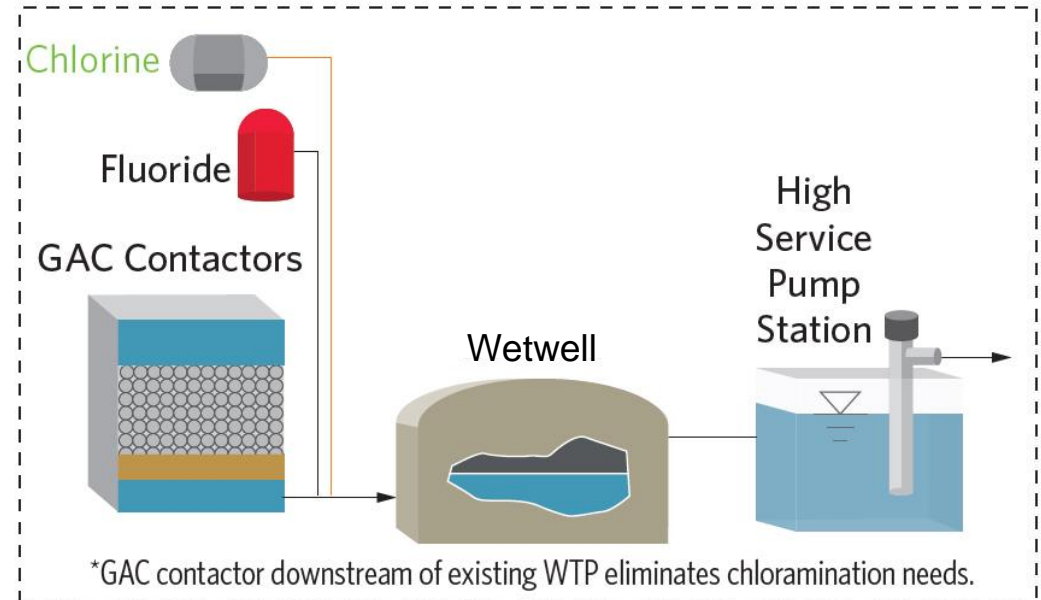




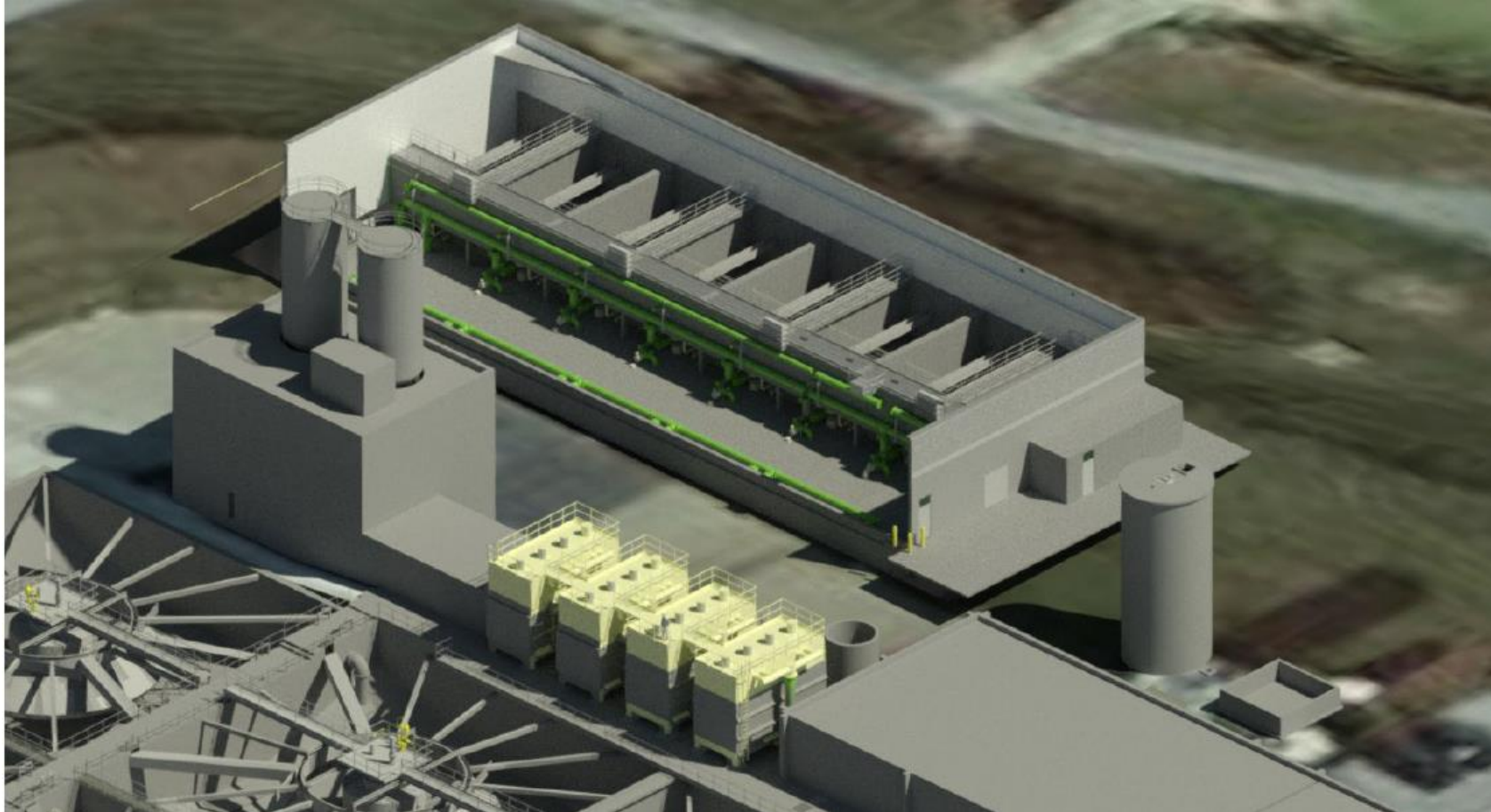
# GAC Contactor Recommended Alternative for Free Chlorine Primary Disinfection



## **FUTURE POTENTIAL IMPROVEMENT - GAC CONTACTOR\***



# GAC Contactor Recommended Alternative for Free Chlorine Primary Disinfection



# Opinion of Probable Cost for GAC Contactor

<b>Total Class 5 Construction Cost Estimate</b>	<b>\$46,700,000</b>
<i>Class 5 Range Low (-15%)</i>	<i>\$39,700,000</i>
<i>Class 5 Range High (+25%)</i>	<i>\$58,400,000</i>

<b>Item</b>	<b>Cost (\$)</b>
Annual GAC Replacement Cost	\$2,670,000 - \$4,160,000
Annual Power Cost	\$20,000
Total Annual Operating Cost	\$2,690,000 - \$4,180,000
20 year Present Worth	\$98,700,000 - \$127,300,000

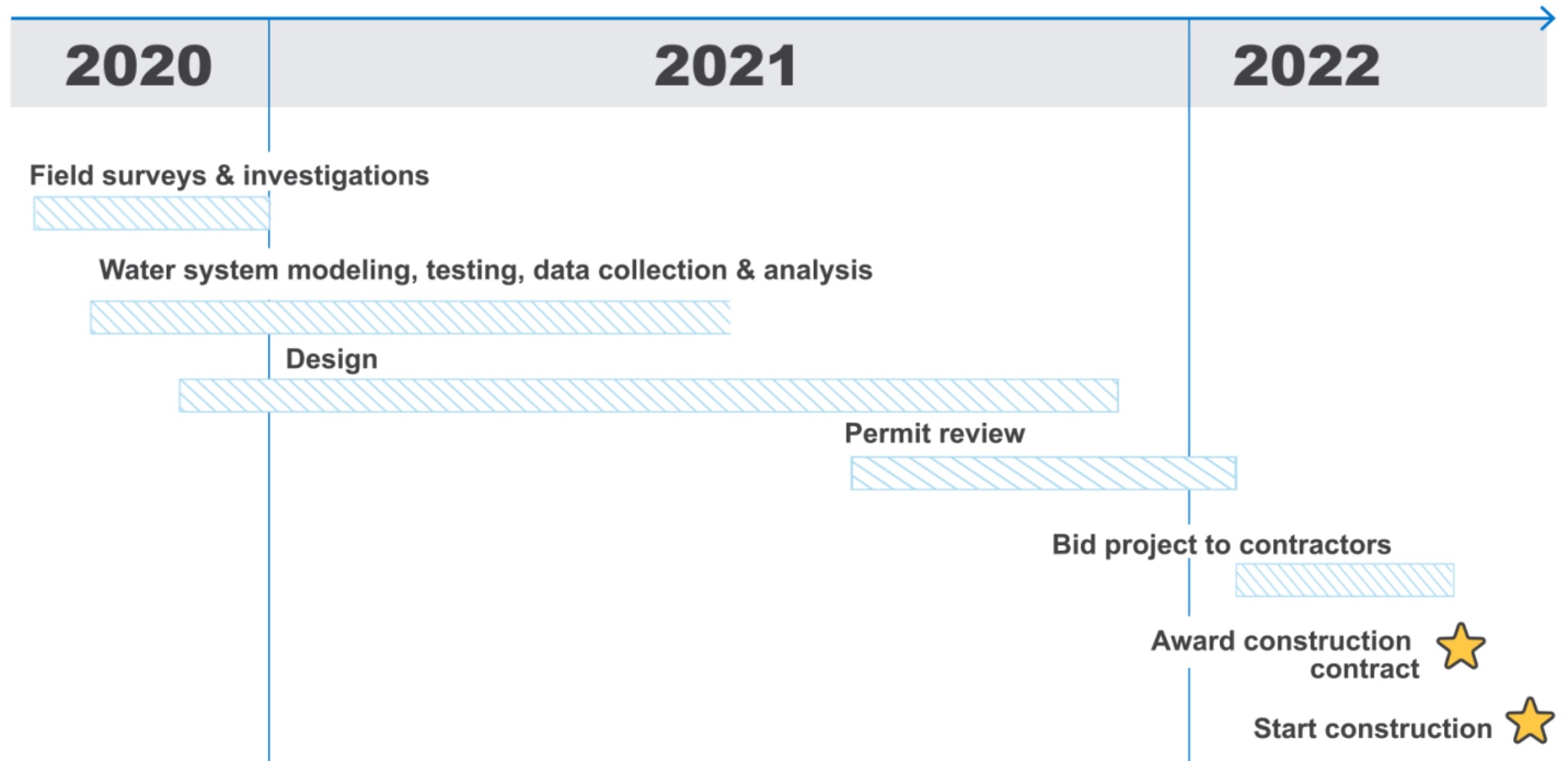


# Pilot Study and Alternatives Analysis

## Conclusions

- GAC contactors recommended for free chlorine disinfection based on current treated water quality
- DBP water quality goals significantly impact life-cycle costs
- Current WTP improvements may improve removal of DBP precursors (TOC)
- Improved TOC removal may reduce GAC life-cycle costs
- Biologically active filtration may be a future option depending on full-scale TOC removal

# Project Schedule (Current Improvements)



# Engagement Opportunities



[como.gov/utilities/mcbaine-wtp-project/](https://como.gov/utilities/mcbaine-wtp-project/)



@ColumbiaWaterLight



573.874.CITY (2489)



[WLmail@CoMo.gov](mailto:WLmail@CoMo.gov)



Virtual meeting dates TBD



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2 hrs · 🌐

Our free residential energy assessment of your home will provide energy and water efficiency tips specific for your location. Sign up using our online sign-up form: <http://www.columbiapowerpartners.com/sign-up-form/>

**Think your house can take the heat?**



**Our on-site evaluation includes:**

☒ Energy and water usage

☒ Insulation levels

☒ Equipment efficiency

Government Organization in Columbia, Missouri

Always Open

**Community** See All

2,505 people like this

2,738 people follow this


26 check-ins

**About** See All

**OLUMBIA**

701 E Broadway, PO Box 6015 (319.71 mi)  
Columbia, MO, MO 65201

Get Directions

**City Source**  
CoMo.gov April 2021

**City Stats**

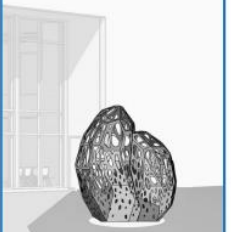
National Volunteer Week is April 18-24. In 2020, City of Columbia volunteers saw great successes.

Consolidated  
3,040  
gallons of paint

Picked up  
5,003  
bags of litter

Shared  
2,363  
hours on Park Patrol

**Molly Thomas Bowden Neighborhood Policing Center  
nears completion**



The stainless steel sculpture by Missouri artist Beth Nybeck will be installed at the rear entrance of the building and is part of the City's Percent for Art program.

The City of Columbia's first neighborhood policing center, named in honor of fallen officer Molly Thomas Bowden, is near completion. The center is located at 1204 International Drive and will serve as a multifaceted hub for community members and officers. A ribbon cutting will be held this spring to commemorate the opening of the facility.

Once operational later this year, the Molly Thomas Bowden Neighborhood Policing Center will consist of a 24,539 square foot space, which includes offices, a lobby, reception area, community meeting room, department meeting room, specialized storage, locker rooms and a fitness center. The center will ultimately serve as a symbol for those who protect and serve us every day and officers like Molly, who gave the ultimate sacrifice to protect her community.

Professional Contractors and Engineers, a local construction company, began the construction of the policing center in March 2020. The new police facility was approved by voters in 2015 as a capital improvement project. The total project cost is \$9.69 million and is funded through the 2015 Capital Improvement Sales Tax. The total cost for building construction was \$7.6 million.

Additionally, community members will enjoy a piece of public art, created by Missouri artist Beth Nybeck that will be installed near the entrance. This component of the building is sponsored by the City's Percent for Art program, which is hosted through the Office of Cultural Affairs.

For more information, please visit our website at [CoMo.gov/police](http://CoMo.gov/police).

**Official COVID-19 Vaccine Information**  
Visit [CoMo.gov/COVIDVaccine](http://CoMo.gov/COVIDVaccine)

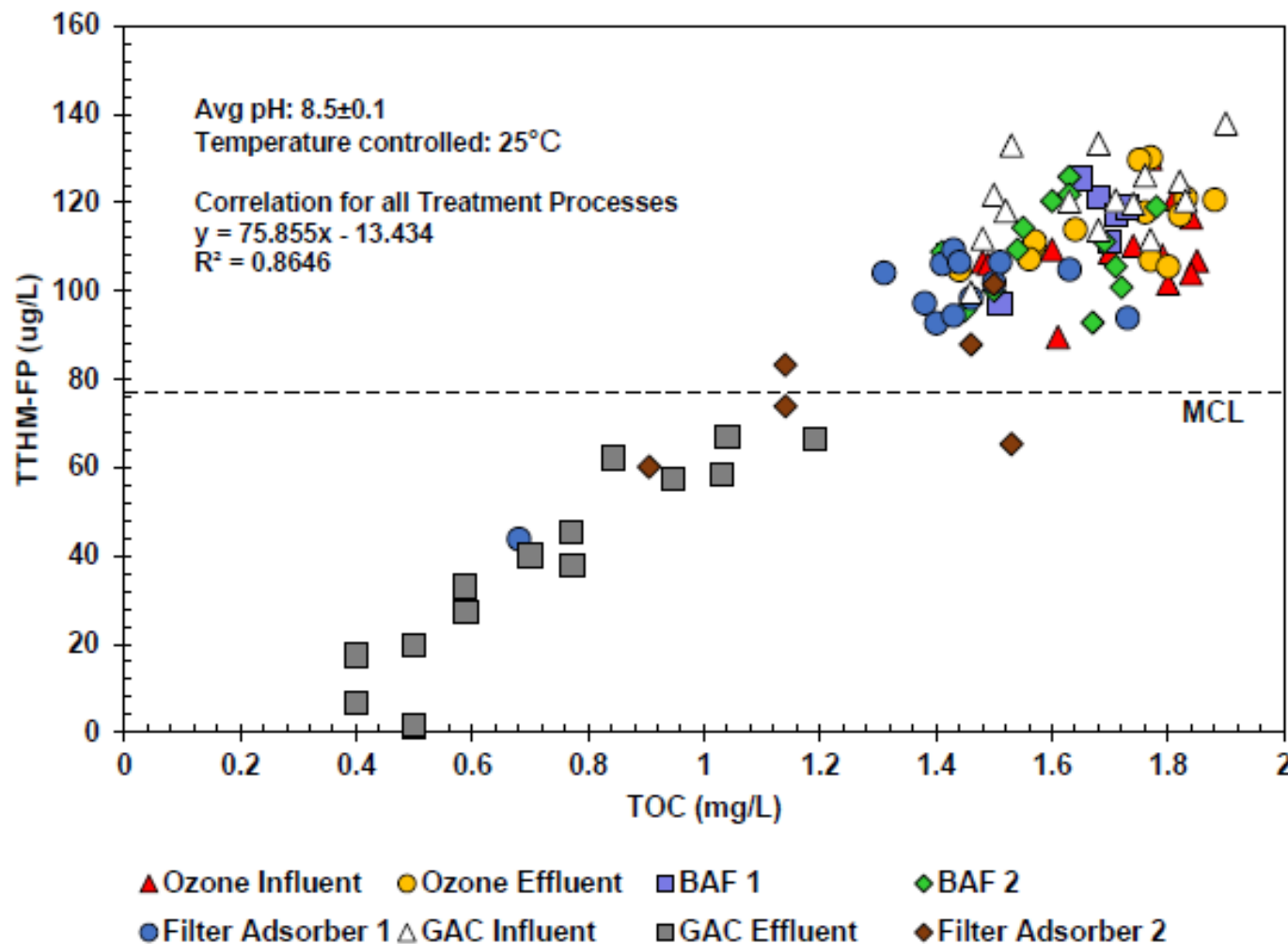
573.874.CITY (2489)  
TTY (MoRelay) 711

City of Columbia, Mo. Government

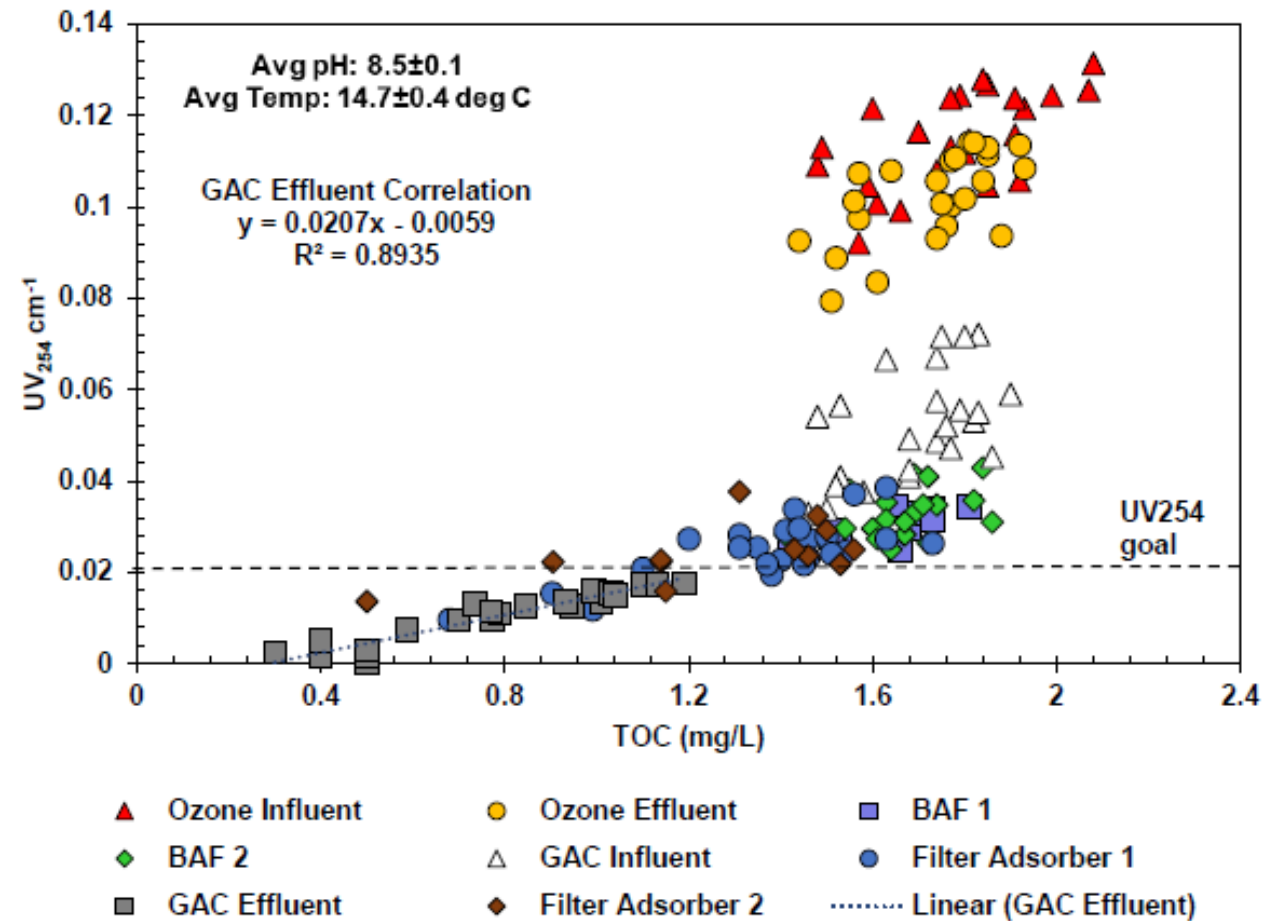
@CoMoGov



# Correlation between TTHM Formation Potential and Total Organic Carbon

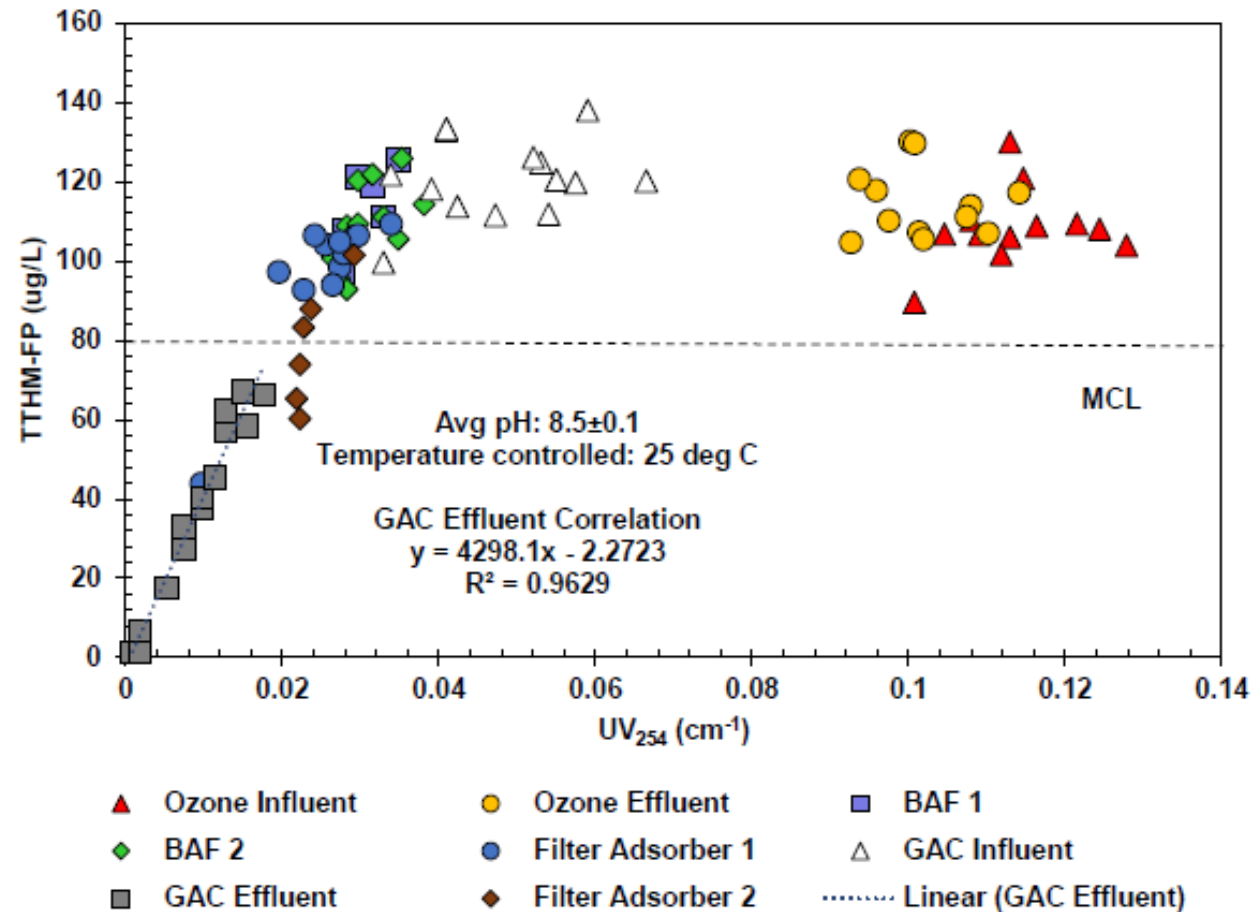


# Correlation between Total Organic Carbon and UV<sub>254</sub> Absorbance

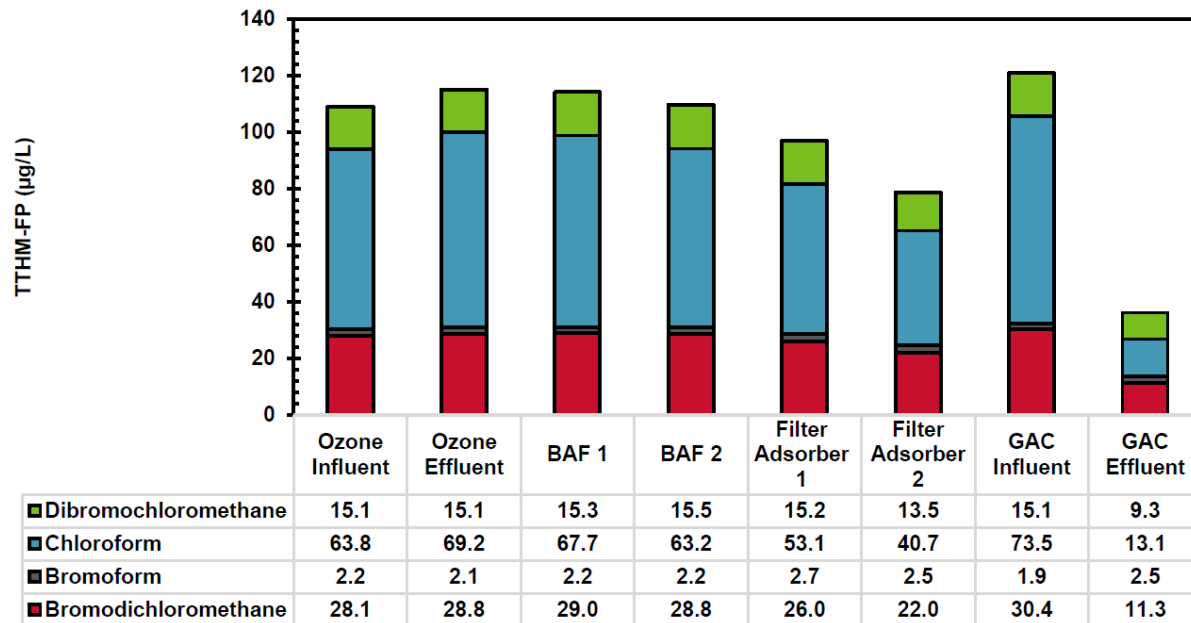




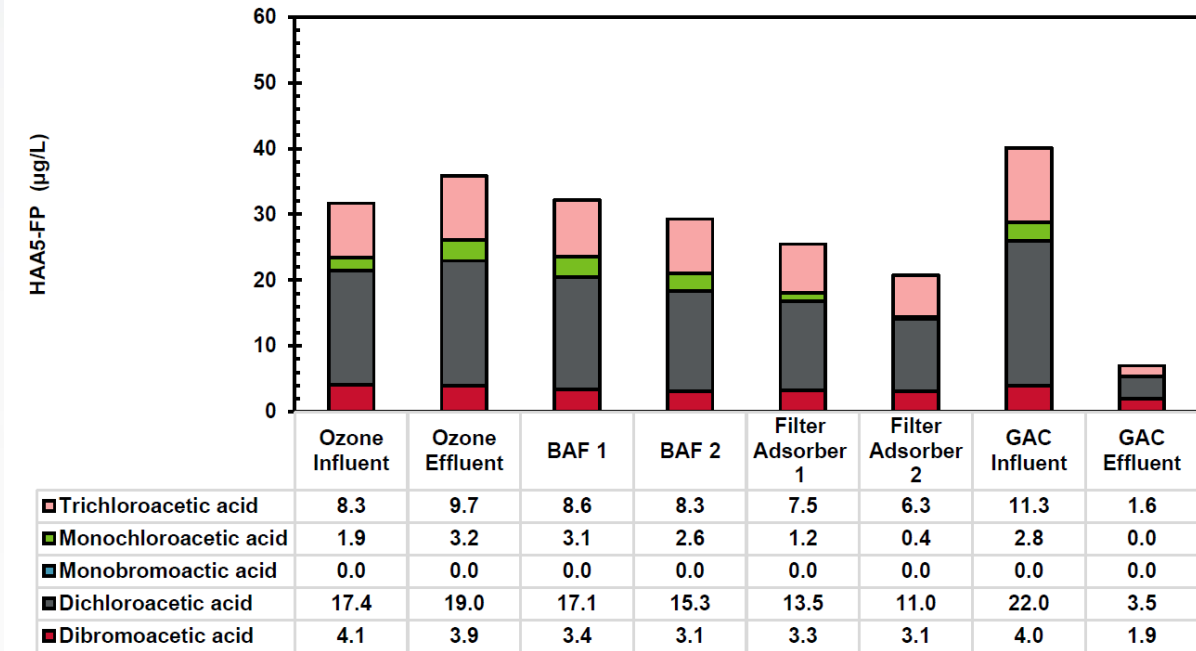
# Correlation between TTHM Formation Potential and UV<sub>254</sub> Absorbance



# DBP Speciation

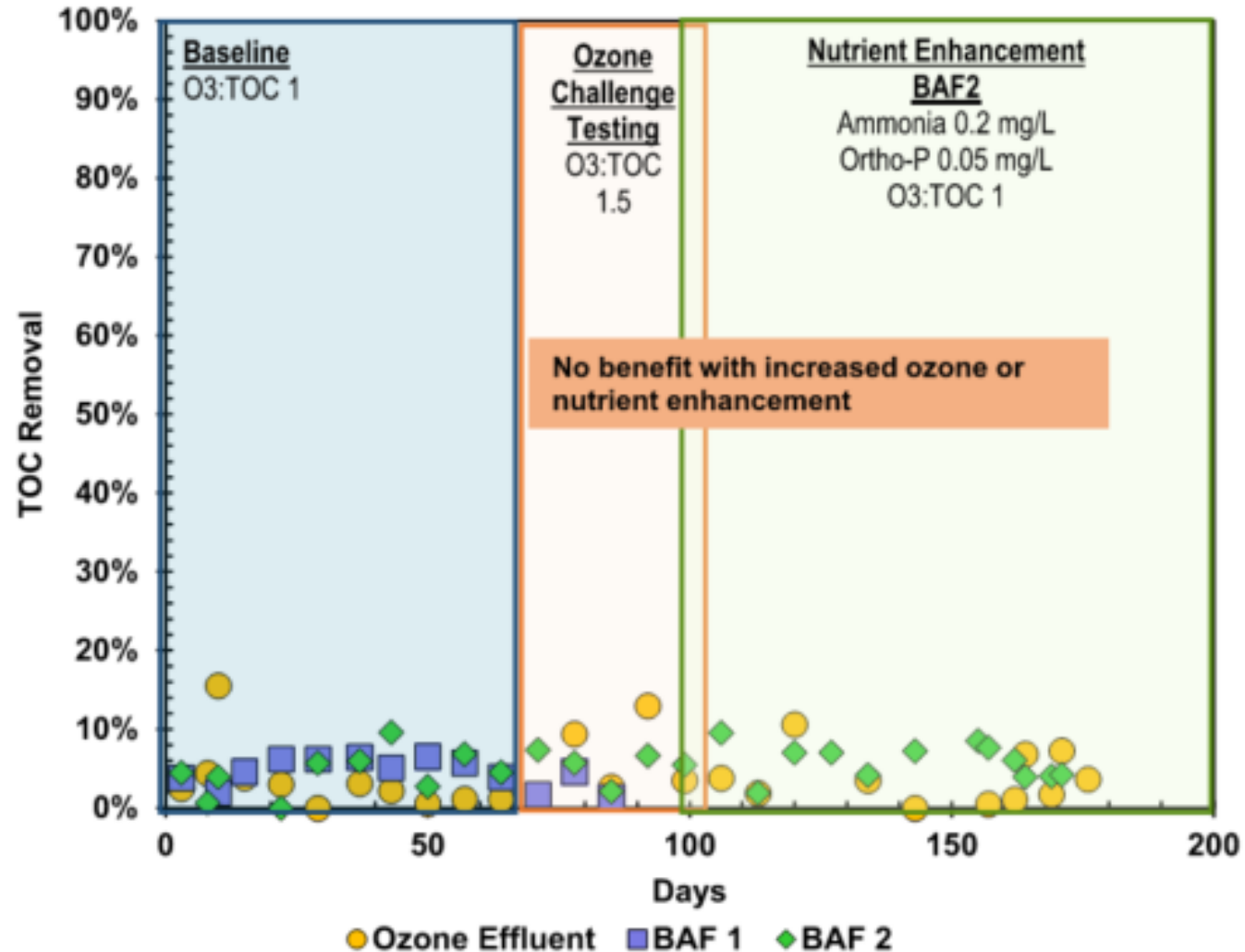


Total Trihalomethanes



Haloacetic Acids

# TTHM Formation Potential of Ozone/Biofiltration Effluent



# Potential Water Quality Goals with Free Chlorine Primary Disinfection

